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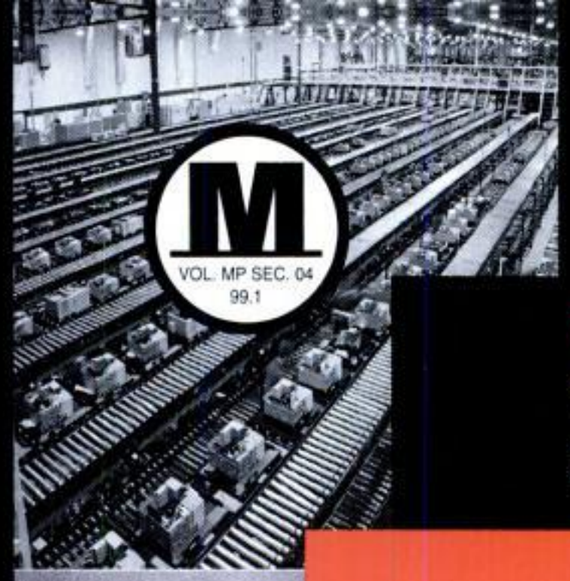

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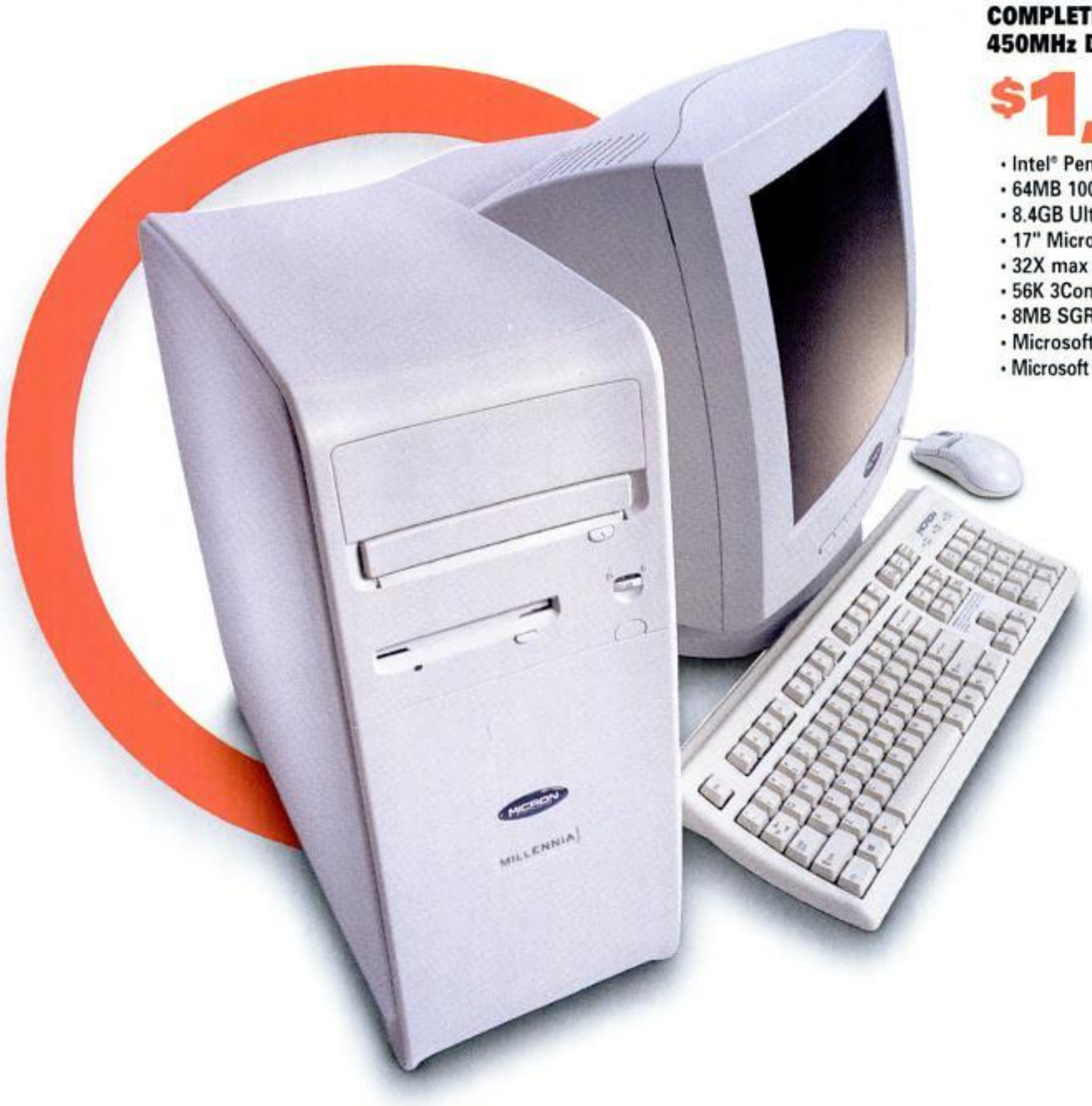

The Critics Rave

PC WORLD BEST BUY
Millennia 400 MAX
*1 Power Desktop
Dec '98

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Millennia 400 MAX
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Millennia 400 DVD
Sept '98
Oct '98

PC WORLD BEST BUY
Millennia 350
Sept '98
Oct '98

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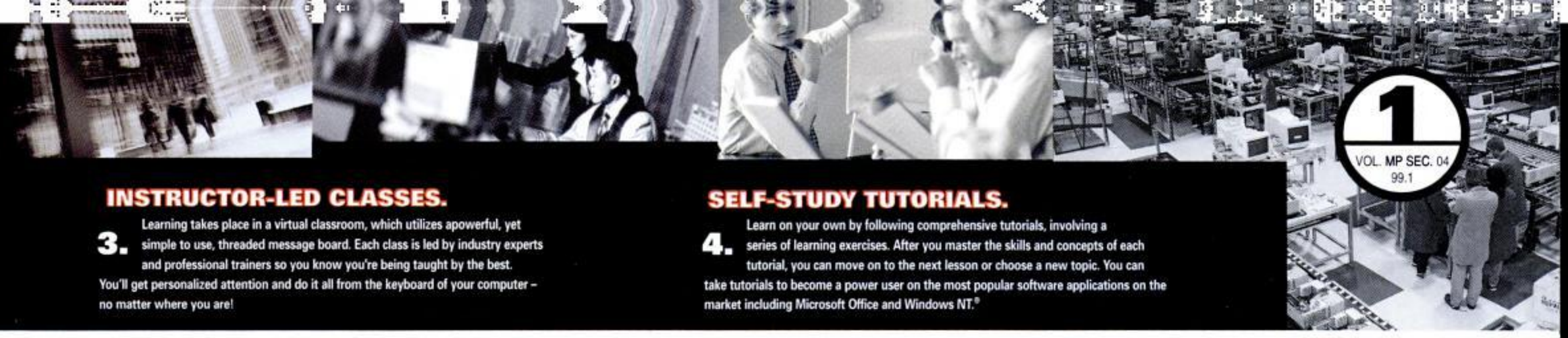

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Processor	Intel® Celeron™ processor 333MHz	Intel Pentium® II processor 350MHz	Intel Pentium II processor 450MHz	Intel Pentium II processor 450MHz	Intel Pentium II processor 450MHz
Cache	128KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache	512KB internal L2 cache
RAM	32MB SDRAM	64MB 100MHz SDRAM	64MB 100MHz SDRAM	128MB 100MHz SDRAM	128MB 100MHz SDRAM
Hard Drive	4.3GB Ultra ATA hard drive◆	8.4GB Ultra ATA hard drive◆	8.4GB Ultra ATA hard drive◆	13.6GB Ultra ATA hard drive◆	14.4GB 7200RPM Ultra ATA hard drive◆
Monitor	15" Micron 500Vx monitor (13.8" display)	17" Micron 700Vx monitor (15.9" display)	17" Micron 700Vx monitor (15.9" display)	19" Micron 900Lx monitor (18" display)	19" Micron 900Lx monitor (18" display)
DVD/CD-ROM	32X max speed CD-ROM drive	32X max speed CD-ROM drive	32X max speed CD-ROM drive	6X DVD III ROM drive	6X DVD III ROM drive
Modem	3Com U.S. Robotics 56K WinModem**	3Com U.S. Robotics 56K WinModem**	3Com U.S. Robotics 56K WinModem**	3Com U.S. Robotics 56K WinModem**	3Com U.S. Robotics 56K WinModem**
Graphics	nVidia Riva 128, 4MB SGRAM 3D AGP graphics	nVidia Riva 128, 8MB SGRAM 3D AGP graphics	nVidia Riva 128, 8MB SGRAM 3D AGP graphics	16MB Diamond Viper 550 TnT 2X AGP graphics	16MB Diamond Viper 550 TnT 2X AGP graphics
Sound System	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 128-voice Wavetable sound	PCI 128-voice Wavetable sound
Warranty	5-year/3-year Micron Power™ limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty	5-year/3-year Micron Power limited warranty
Scholarship	1-year free‡ tuition to Micron U online	1-year free‡ tuition to Micron U online	1-year free‡ tuition to Micron U online	1-year free‡ tuition to Micron U online	1-year free‡ tuition to Micron U online
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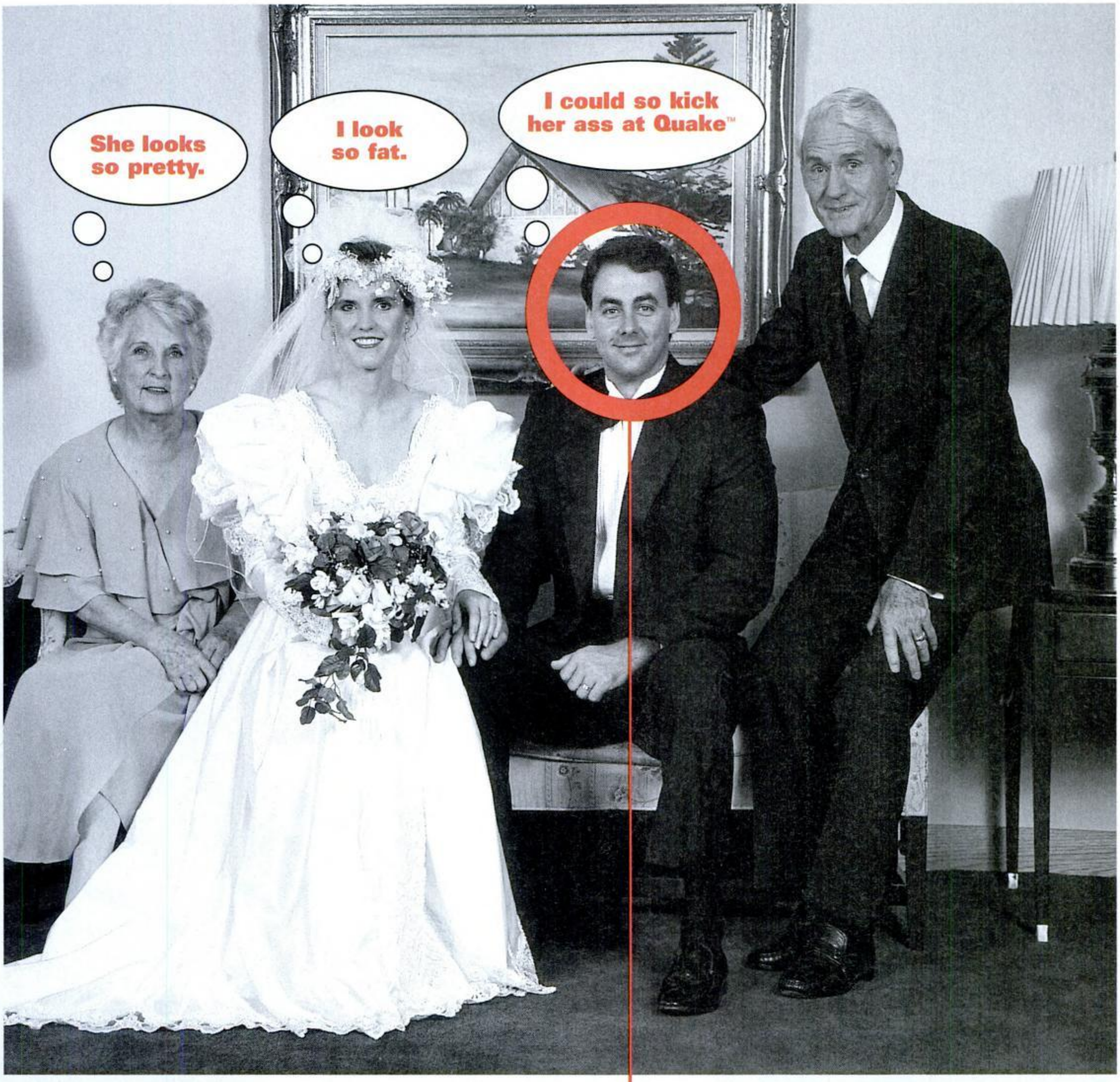

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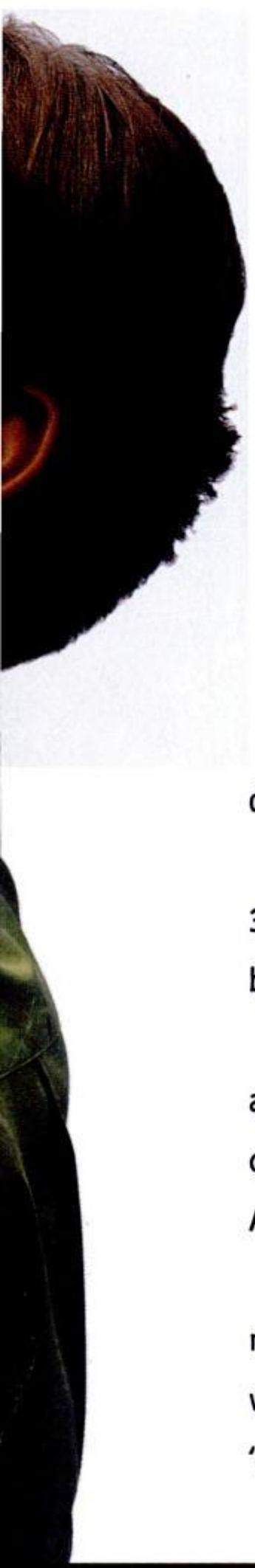

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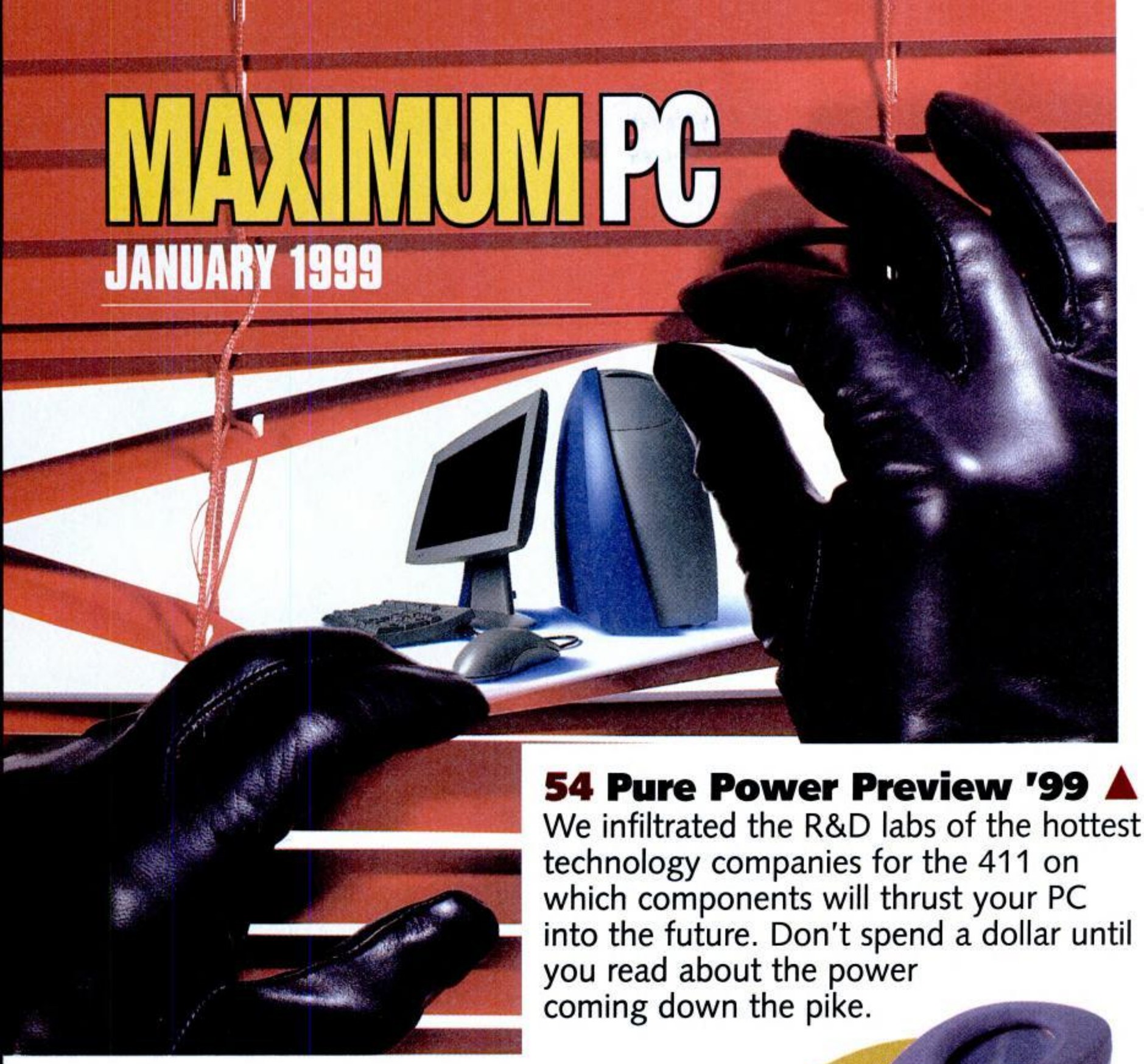

54 Pure Power Preview '99 ▲

We infiltrated the R&D labs of the hottest technology companies for the 411 on which components will thrust your PC into the future. Don't spend a dollar until you read about the power coming down the pike.

70 USB Bonanza ▶

1998's no-show technology is ready for a major roll-out in '99. We have printers, scanners, mice, modems, hubs, cables... even USB phones. All racing at 1.2 megs per second! The USB showroom is now open for business.

◀ 44 Interrogation

With its new SoundBlaster Live! soundcard, Creative Labs is once again sitting on top of the world. From his perch high above, **Dave Rossum**, the company's self-proclaimed Chief Wizard, spills the beans about PCI audio and 3D sound, and explains why Aureal's A3D technology just plain sucks.

TOC

05

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Contents

05

▶ VOICES

10 Ed Word
Big Daddy thinks you deserve a chance to own the best PC money can buy. Don't let anyone tell you differently.

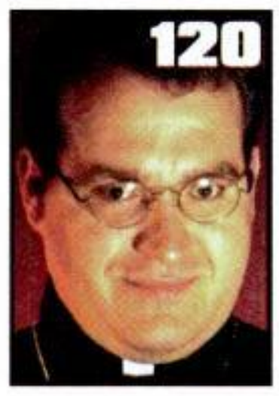
14 Comm Port
The Smartest Readers in the World let loose the latest salvo of letters. We circle the wagons and fire back responses.

37 Fast Forward
High-tech Yoda **Tom Halfhill** describes his burning desire to see Cyrix's hot new processor and explains why the Jalapeno is a CPU you can swallow.

39 On the Line
Web savant **Shel Kimen** examines the latest round of WYSIWYG HTML editors and finds three that don't suck.

41 Game Theory
Gaming guru **T. Liam McDonald** responds to the huge wave of letters from the many readers residing in Sierra's special place in Hell.

120 The Saint
Industry insider **Alex St. John** gives his testimony in the Microsoft antitrust trial and weighs in on the side of the underdog.



▶ NEWS

22 Inside Sources
News you need to win the tech race

▶**SGI** is serving up a fat plate of fixin's at the NT workstation mess hall and threatening a major food fight with the established system manufacturers. Is this a last ditch effort to save an anemic company or the beginning of fatter days at SGI?

▶And... **The PC '99 spec** defines what will comprise the PC of the future. Parallel and serial ports are falling by the wayside and the ISA bus is forever banished, so should we be afraid just because Microsoft is pushing it.

Can SGI compete in the NT race?, p.22

SGI 1600SW Flatpanel, p.92

▶ TECH FILES

29 Watchdog
Ripped off by a manufacturer? **The Watchdog** investigates your complaint and exacts justice against those who've wronged you.

75 Ask the Doctor
Open up your PC and say ahhh. **The Doctor** will diagnose all your PC ills and bring prompt relief to your technical difficulties.

115 Terminator
All the geeky tech terms strewn about the magazine explained in plain English.

▶ PRODUCTS

35 Peripheral Vision
High-tech digital toys and cutting-edge gear for digital girls and boys and systems without peer.

79 Reviews
We take the hottest new hardware and the latest software and test it till it catches fire!

▶This month we bathe our eyes in the visual splendor of **Silicon Graphics'** new flat panel, light a fire under new **DVD** kits from **Sony, Hi-Val,** and **Creative Labs,** catch the new **JDR Xeon** gaming system with its pants down, fire buckshot into **Trespasser**'s supposedly superior software-rendering engine, and get blown out of our chairs by the aureal intensity of **Diamond's MX-300**. And much more!

FoneCam, p.35

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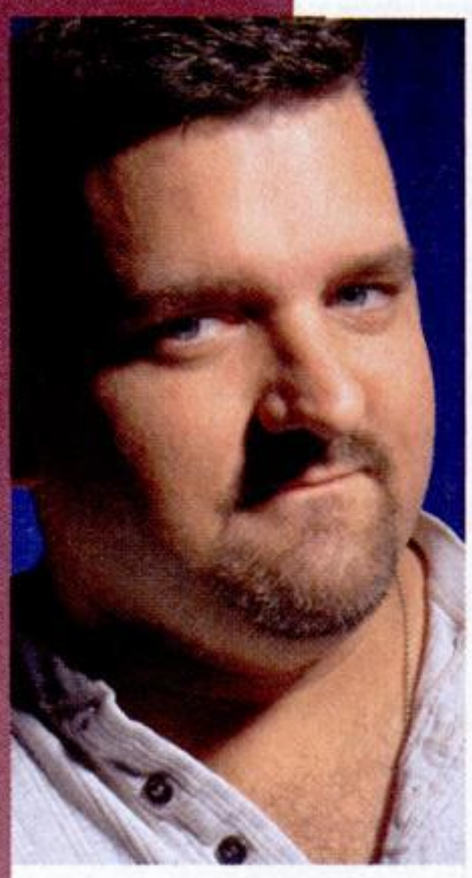
ED WORD

What Price Power?



Don't believe what every commission-hungry salesperson spews and don't blindly believe specs.

Last month in this column, I mentioned the growing attention the PC industry is focusing on low-end gear and expressed concern over what this meant for us Pure PC Power fans. This month, I want to talk a little about the price factor.

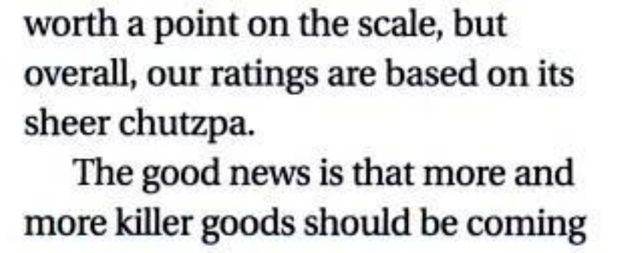
It's not that I want to pay top dollar. Frankly, I want the most bang for my buck, just like you. But one thing I do want is bang. I want the leading companies in this business to continue making gear dedicated to pushing the envelope, and not to spend all their energy catering to the profit margins they imagine the low-end promises. Like most of you, I want the parade of jaw-dropping technology—from Pentium II to 3D video accelerators to PCI-based soundcards—to continue, but I know that we are the minority. Most people just don't understand our obsession with bigger, faster, better. There may be more people out there content with "passable" PCs, but with the trickle-down effect of high-end to low-end, we all suffer when the companies that create these parts forget about the power user.

Technology has few constants, but one of them is that it always travels in one direction: forward. The 486 will never make a comeback, the ISA bus is dead, and you should never have to settle for a cut-rate CPU without cache. People who go and buy bargains from the back of the curve and then complain about obsolescence deserve no pity. Can't play *Quake: Arena*? Can't decode your DVD in software? Can't upgrade your soundcard because there aren't any open slots? Sorry, you get what you pay for.

I don't assume we're a bunch of millionaires, and I'm not encouraging everyone to buy from the very cutting-edge of the curve. Until a standard is established for any given technology, that practice has equal risk and reward. But if you care about your PC experience, you should get the best you can afford. And you should invest the time and energy into doing your homework and shopping smart. Don't believe what every commission-hungry salesperson spews and don't blindly believe specs. Try it yourself. Benchmark it with the apps you use. That's what we do and that's a service we want to provide for you: zero BS reviews of the products worth owning.

Still, how much of a factor is price in our reviews? Well, that's a controversial issue. We try not to assume how much any one person is willing to spend for any given piece of technology. You are too diverse and your priorities vary too much for us to project our values onto any of you. If a product's priced wildly more or less than comparable offerings, that's worth a point on the scale, but overall, our ratings are based on its sheer chutzpa.

The good news is that more and more killer goods should be coming our way. A recent front-page story in the *Wall Street Journal* explained how the low-end market had fallen off, and that given a choice, "a majority of buyers are choosing to pay more for more up-to-date features." Yesterday's machines running yesterday's technology just aren't cutting it for those of us who demand more than word processing and rudimentary web surfing. It's like typical consumer Martin Slattery of Plano, Texas, explained in that same *WSJ* story, when asked why he passed on a cheap PC, "They're not good enough."



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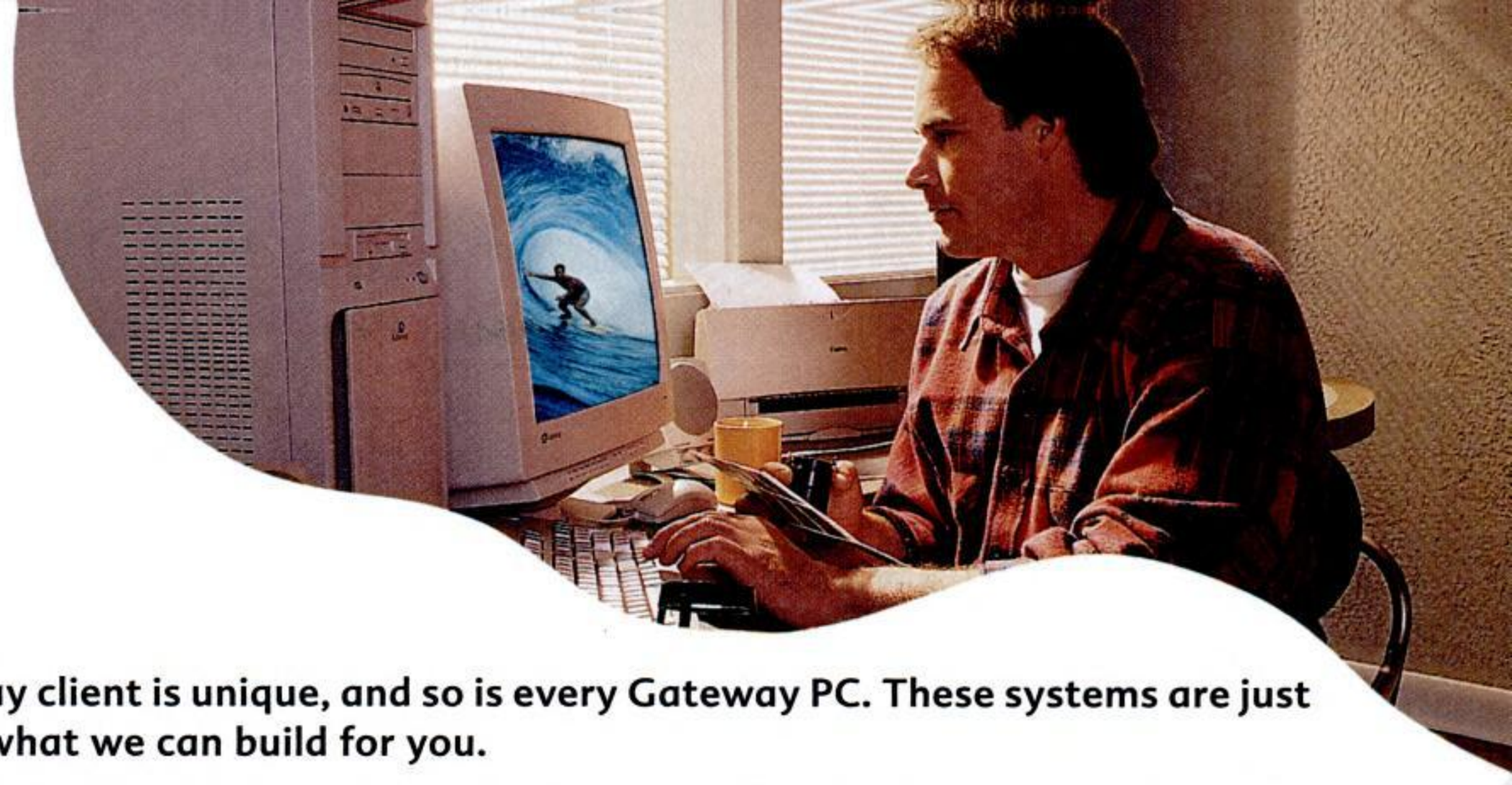

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COMM PORT

This month:

- ▶ Reviewers reviewed
- ▶ The 56K rule
- ▶ Bogus P-IIs proliferate
- ▶ Warning to overclockers
- ▶ Stupid DMA tricks
- ▶ Kill the AOL messenger

Letters from the Smartest Readers in the World

Here's the deal: You (being the smartest readers in the world) write letters about the magazine, the PC industry, the software you love or hate, and the hardware that runs it. We read it and share as much of it as space permits in the mag and online, and respond or comment when the letter calls for it. Get it? Now get busy and write us at **commport@maximumpc.com**.

Consider the Source

There are a couple of problems with the "idea exchange" paradigm in your November 1998 Ed Word column. When you start to publish the opinions of your writers intermingled with the review of a hardware or software product, you lose credibility.

As soon as I realize the social leanings of the reviewer, I discount the review, and will discount all reviews by that individual in the future, because I now know that they can't give an impartial review. His personal opinions and motivations may slant his review.

I pay good money for reviews that I can trust, without worrying about the motivations of the reviewer. If I have to decode each review as a function of the reviewers "opinions," I'm wasting my time and have no further use for your magazine.

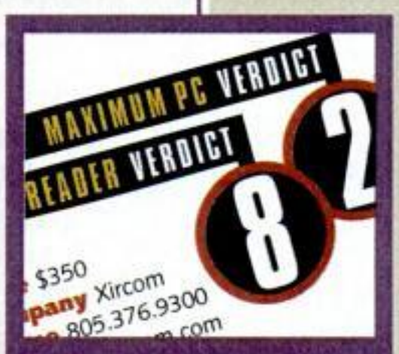
—Ian Buchanan

I'd like to indulge in a message to all the whiners, some of whom you quoted in the November 1998 issue: Opinions are like a-holes, everyone's got one, and no one is particularly interested in yours. So let's go trolling with a few of mine, in complete and utter disregard for the preceding aphorism.

A review is the reviewer's perspective. There is no such thing as objective truth, and when you disagree, try to bear that in mind. If the reviewer is too far off base from the readership, he or she generally doesn't stay a reviewer very long, so it's a self-correcting system. Therefore, if you disagree, you're probably voicing a minority opinion. Being in a minority doesn't give you the right to try and convert the heathen who seem to be outnumbering you.

Try a little tolerance, it's quite possible to entertain even the most outrageous points of view while retaining your own firm convictions. You might be surprised at what you might learn. Remember understanding is not condoning. The problem with Zero Tolerance policies is that they breed intolerance and hatred.

—James Dean



"If the reviewer is too far off base from the readership, they generally don't stay a reviewer very long, so it's a self-correcting system."

Out Damn Spot

You know what sucks? Netscape's new partner, AOL, and its damned Instant Messenger. The damn thing is always there. There is no way of not installing it.

There is no way of uninstalling it... beyond registry manipulation. Even when I told AOLIM that I didn't want to use it, every once in awhile... BLAM! It's in the system tray, or the icon will appear momentarily at the end of system startup. What's up with that? Netscape and AOL are pissing me off!

—Anthony Lewis

Departments Editor Sean Downey replies: You can get rid of the random AOL Instant Messenger prompt by going through the Sign Up process, hitting the Setup button when the small Sign On screen comes up, and unchecking the "Start Netscape AIM when Windows starts" in the Misc. section.

The quick and painless way to do this is through RegEdit. Browse to the Hkey_Current_User\Software\Microsoft\Windows\CurrentVersion\ Run key and delete the AOL Instant Messenger Entry found there and the AIM prompt will never bother you again. That is, until you upgrade your browser and Netscape pisses you off all over again.

DMA Side Effects

When I ran HD Tach to test my 8GB NEC hard drive, I noticed CPU utilization was at 90. I quickly realized that my Dell Dimension had left the factory without the DMA option on! I can understand companies ignoring gripes about prices, support, late release dates, etc., but what could possibly make a company not want to check that little box in the Control Panel?

Not everybody in the world knows about DMA. They should have it checked. It's not like it's overclocking. Are there any side effects to DMA?

Anyway, I tried it again and got much improved scores and a 3.4 CPU utilization. But for some reason, even though the sequential speed started out much faster, it gradually lost steam, until it went below where it was before (but not too far below). Is this expected?

—Bill Wanjohi

Technical Editor Sean Cleveland replies: We hate it when DMA isn't properly enabled (although we do love to beat up companies that forget it).

Used to be that nobody enabled or even knew about DMA. But that's changing. As you already

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Time for his walk.
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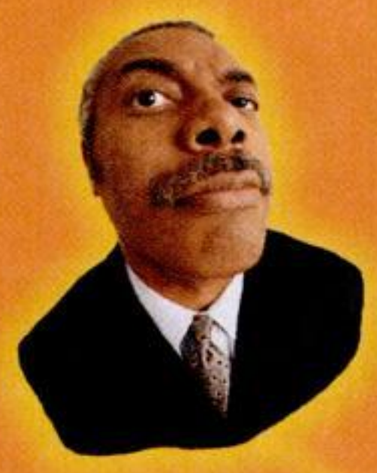

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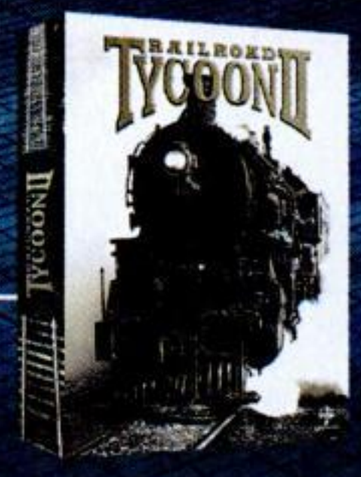

A Strategy Trainfest.

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know, DMA (Direct Memory Access) takes a heaping load off the CPU by not requiring the CPU to negotiate data transfers between the hard drive and memory (hence the name Direct Memory Access). You saw this when you enabled DMA. Some drives do show improved read/write performance, although older EIDE drives do not. You'll see more of an improvement in read/write performance in newer Ultra DMA drives. Even if your speed does decrease, it's still better to run with DMA enabled.

Tribe Called SyQuest

Now that SyQuest is filing for bankruptcy, who will support the SparQ drive that I foolishly bought believing it to be a good investment? It hardly ever works correctly. The media is seriously flawed, and the drive seems unable to do what it's supposedly designed to do. Will they be offering refunds?

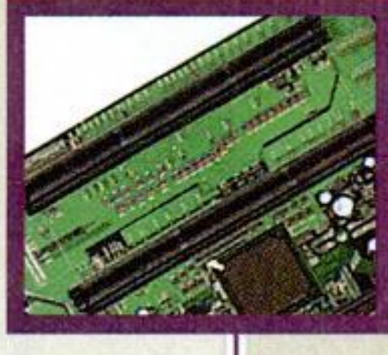
—Mark Faine

Not only do we have to deal with bad OSes and beta software sold as finished products, but we also have to be stock brokers and keep track of a business's assets to feel safe buying from them.

Contacting SyQuest proved impossible; have you heard of anyone picking up SyQuest's support obligations? Or am I out of luck again?

--Jim Willoughby

News Editor Bryan Del Rizzo replies: At press time, SyQuest had just filed bankruptcy. The company will be selling its patents, and a portion of the proceeds will be allocated for warranty service for products already sold. As for refunds, if you desire, you can always file a claim with the bankruptcy court.



"My P-II 450 Xeon chip with 2MB of cache disappeared like it had been taken by a ghost or some other supernatural force."

No Chip, Sherlock

I misplaced my P-II 450 Xeon chip with 2MB of cache. A friend was installing it and while he had the case open, I went to the kitchen to get a glass of milk. When I returned, he said it disappeared, along with my Seagate Elite Ultra 2 SCSI 47GB hard drive. He said it was there one minute and gone the next, like it had been taken by a ghost or some other supernatural force. What do you think could have happened?

—Matt Carse

Online Editor Gordon Ung replies: Remember that guy who bumped into you as you walked into CompUSA? That was you from the past. Matt "McFly" Carse was trying to prevent you from making a serious mistake, like buying the old Celeron without cache. Once the mistake was corrected, the timeline was set back in its proper place and your CPU vanished.

Do As I Say, Not As I Do

Intel says we should get rid of the ISA bus, but its own motherboards don't follow that advice. If they are going to tell others what to do, why don't they do it themselves?

—Mike Ditty

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Senior Editor Andrew Sanchez replies: With the recently ratified PC 99 specification ready to roll (see page 24 for more info), you can bet this year's motherboard crop will be ISA-less. Everyone who's doing motherboards is slated to follow the PC 99 spec, which calls for an ISA-slot-free motherboard. When will we see them? Probably by Q2 of 1999. And yes, Intel will be among the ISA-less crowd.

The Three-Mile Rule

As with anything in this world, 56K modems have their limits. 56K modems work above 33.6 only if you have the same protocol as your ISP (K56flex, 56K X2, or V.90). You also have to be within three miles of your telephone switch to take advantage of a 56K modem's capabilities. If you do not meet these two simple requirements, you will only get connect speeds up to 33.6 at best.

When I sell a system, I find out where my customer is located and what ISP they are using before recommending a modem. If they won't benefit from a 56K, I will only recommend a 33.6. It's that simple.

—Daniel Wright

Keepin' It Real

I recently purchased four 450MHz Pentium IIs from a distributor. After continuous system crashes and locks, I was angered to find out that my $2,400 was spent in vain. Every one was a re-marked or counterfeit chip. I've heard of this problem with 300s and 333s overseas, but I didn't realize the problem was so widespread in the United States.

I contacted Intel, and they verified my findings and are conducting an investigation. I spoke with the support staff where I purchased the processors and they checked the rest of their inventory. Sure enough, the whole lot was re-marked. The company refunded my money and I went out to buy new ones. I checked several different distributors and after asking for part markings off their processors, I was shocked that three of the ten places I contacted also had re-marked processors. They were all what is referred to as "OEM processors." These are the type of bulk packs that system integrators buy from Intel. After talking to Intel, their suggestion was to buy a retail-boxed processor from a known distributor. The boxed version carries a three-year warranty from Intel. It costs a little more, but it's probably worth it.

—Forrest R. Haines

News Editor Bryan Del Rizzo replies: It is worth it. Your situation is a good example of why you should always buy goods from a reputable firm. If the vendors you're buying from use disreputable suppliers to save a few bucks on their end, you shouldn't grace them with your cash. We've received hundreds of letters from readers who have been ripped off, big and small, and our best advice is to buy from someone you trust. In your case, this is Intel. At least you know they won't be ripping you off.

Let's Play Master and Servant

I was told if you have an Ultra DMA hard drive and a non–Ultra DMA hard drive as master/slave on the same cable, the Ultra drive will perform like the non-Ultra drive.

"I was shocked that three of the ten places I contacted also had re-marked processors."

If you have the two drives and a CD-ROM drive and only two IDE cables, how should you hook them up?

—Mike Connor

Technical Editor Sean Cleveland replies: Make the hard drive that supports Ultra DMA mode the master drive on the primary bus. Separate it from the slower, non–Ultra DMA hard drive by making that drive the master on the secondary bus. Put the CD-ROM drive on the secondary bus with the non–Ultra DMA hard drive and jumper it as the slave. You don't need to buy a separate IDE card until you've filled up all four available IDE connectors (two per channel). If your cables only have a connector at either end, replace them with cables that have three connectors.

Need Good Home For Katmai

What chipset will the new Intel Katmai processors use? Is there a motherboard out today that will support these new chips?

—Frank Carberry

Senior Editor Andrew Sanchez replies: Any Intel 440BX-based motherboard is Slot 1 Katmai-ready! According to Intel, the 440BX will be the main building block of Katmai. So, expect a flash BIOS update and new jumper settings from your favorite 440BX motherboard maker to come in the next few months. With those in hand, Katmai is but a CPU install away.

Danger, Danger, Will Robinson

Why do you guys always talk about overclocking systems? In reality, all overclocking does is shorten your CPU life, heat up your system, cause some programs to lock-up or display errors, and potentially damage your PC's components. You should at least tell your readers that overclocking is not some special way to get your system to go faster, but changing the technical specifications of the bus speed and clock multiplier beyond it's designated speed. Have fun blowing up those new PCs!

—Steve Crowder

Online Editor Gordon Ung replies: C'mon Steve you know you've done it. We've all done it. Bob Dole has probably even done it. While overclocking certainly isn't for everyone, it does fill the need for speed for risk takers. You may nuke your CPU, but for some it's worth it if they get a 450MHz or 504MHz machine by overclocking a 300a or 333a Celeron. The CPU and motherboard generally cost less than $300. For that much, you could fry a machine every 12 months and still be in good shape. Don't do it if you don't feel comfortable, and go for it if you have the need for speed.

RISCy Business

In the article "Get Ready for GHz" published in the October 1998 issue, Tom Halfill makes several references to the use of a CISC-based architecture in Intel processors versus the RISC designs of IBM, DEC, and so on.

Correct me if I'm wrong, but the instruction architecture (CISC or RISC) doesn't necessarily have any bearing on clock speed, since many instructions in the sets take more than one clock cycle, and there exists no direct relationship between instruction set and maximum attainable clock speed. The other issues Mr. Halfill mentions do indeed have a great influence on the ability of a processor to reach 1GHz, e.g. the .18-micron process, the use of copper, SOI, etc.

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Although the RISC-based architecture certainly has advantages in some respects over CISC architectures, I don't believe an intrinsic higher potential clock speed is among them.

—Ramesh Dharan

Columnist Tom Halfhill replies: I'm surprised by your assertion that there's no relationship between CISC, RISC, and clock frequency. One goal of RISC was to streamline instruction processing in order to attain higher clock speeds. A classic CISC architecture such as the x86 is definitely at a disadvantage because of the extra overhead required to fetch, parse, align, and decode the complex variable-length instructions. The latest superscalar x86 processor we've seen, the AMD K7, devotes half of its 10-stage superpipeline to those tasks.

RISC processors don't have to scan the incoming bit stream looking for instruction boundaries (because all instructions are 32 bits long); they don't have to pre-align the instructions before decoding them (because the fixed-length instructions are already aligned on even-word boundaries); and they don't have to parse the instructions to detour the most complex operations to a microcode sequencer (because RISC instructions execute in hard-wired logic instead of in microcode). Clever CISC designs try to hide those latencies by prefetching, predecoding, and resorting to other techniques, but stalls and pipeline bubbles are inevitable.

The extra logic required by CISC processors also enlarges the die and lengthens critical pathways, making it more difficult to achieve high frequencies without clock skew. Compare the die sizes of a Pentium II chip and a PowerPC chip built on similar fabrication processes, and you'll see what I mean.

Speed-demon RISC processors like the Alpha have been the clock-frequency champions for many years, despite the much vaster resources that Intel pours into the x86. The sheer weight of those resources (and the diminishing resources allocated to the Alpha and other RISC architectures) may eventually tip the scale in favor of the x86. But if you ever get alone with an x86 architect, ask him this off-the-record question: If you invested the same effort in a new architecture that didn't have to run x86 software, could you make a faster CPU? I've asked that question, and the answer is always "Of course."

Multiproc Madness

I want to build a dual-processor Linux machine but don't want to pay a hefty price for the processors. Does the K6-2 support multiple-processor configurations? If not, does the new line of Celerons? And who makes motherboards that will accept two of either of these processors?

—Jarod Barkovich

Senior Editor Andrew Sanchez replies: Right now, the K6-2 is not supported via any core-logic chipsets to handle multiple processors. The K6-2 was not designed for high-end servers. With Celeron, it's the same thing. While there are motherboards available based on Intel's 440BX core-logic AGPset that support dual Slot 1 processors, all the specs I've seen tell me you are limited to a single Celeron CPU in these situations.

If any readers have managed to pull off multiproc madness, let us know!

"Overclocking shortens your CPU life, causes some programs to lock-up, and potentially damages your PC's components."

No Hub For Me

Do you really need a hub for 10BaseT Ethernet if you're only networking two computers (like between your laptop and home PC)? I understand that the cables in 10BaseT don't hook up the same way as coax. If you plug a Cat 5 cable between two PCs, the individual contacts won't be properly aligned. That's why I got a crossover plug that inverts the position of the terminals so you can get a direct connection. Only $7 versus more than $85; hmmm... that's a tough decision. Various Internet sources I've read suggest that the Ethernet connection won't be as reliable without a hub administering the network. But what benefit does it really provide?

—Jesse Rehr

Technical Editor Sean Cleveland replies: No, you don't need a hub if you're only networking two computers using 10BaseT connections. It seems we weren't very clear on that. Although some may argue the validity and reliability of such a connection, I'm here to tell you that it works—because I do it (I've tested this at both 10Mb and 100Mb connections). To do this, you'll need a pair of wire crimpers, a regular 10BaseT wire with connectors, and an RJ-45 connector to replace the one you'll cut off. Once you have these, simply swap the transmit/receive lines on one end of the cable. This in effect allows one computer to transmit data into the other's receiving end and vice-versa. There is a handy chart that illustrates this on Compatible Systems web site (www.compatible. com/tech_ support/cable_specs/10baset.co. html).

Is It A Sin To Lust After More RAM?

Thank you for taking the time to read and consider this e-mail. I have received two copies of *Maximum PC* in the mail so far. I've found both to be in poor taste, in covers, language used, and marketing content.

The cover of the Octobert 1998 edition shows a sexy lady sprawled out. I thought your magazine was about computers, so why the sexy woman? God's word, the Bible, says it's a sin to lust after women. What message are you sending with such a cover?

The language used in your magazine seems out of place too. I have read many other computer magazines, all without traces of inappropriate language.

Also, your magazine advertises sexual web sites in the section called Marketplace! Why do you allow advertising that goes against what God decrees to be a sin in the Bible?

I pray you will reconstruct your magazine into one that does not go against principles in the Holy Bible.

Have a nice day!

—Jethro

Cut, Copy, Paste

▶ In our December 1998 "Gear of the Year" feature on page 62, the wrong DVD kit is pictured. The winner of the Best DVD Kit was Hi-Val's DVD-3, which is shown below. *Maximum PC* regrets the error.

Hi-Val DVD-3

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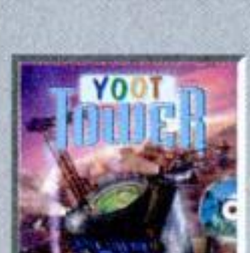
Waikiki



The tower you designed at Waikiki is the ultimate tourist magnet. $3000-a-night hotel suites. Duty free shopping. Korean BBQ restaurants. You're packing them in. Unfortunately, the same could be said for your only elevator. You better spend the dough to build more or the tourists will go to Miami and you'll be taking the express car to bankruptcy. www.yootpc.com

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HAIL CAESAR, YOUR

ACTOR

Can't flub my lines again or the director said he'd turn me over to the lion tamers! Okay... "Et tu Bruno? No, that's not right. "Et tu Brunhilda?" Arghh!!

VINTNOR

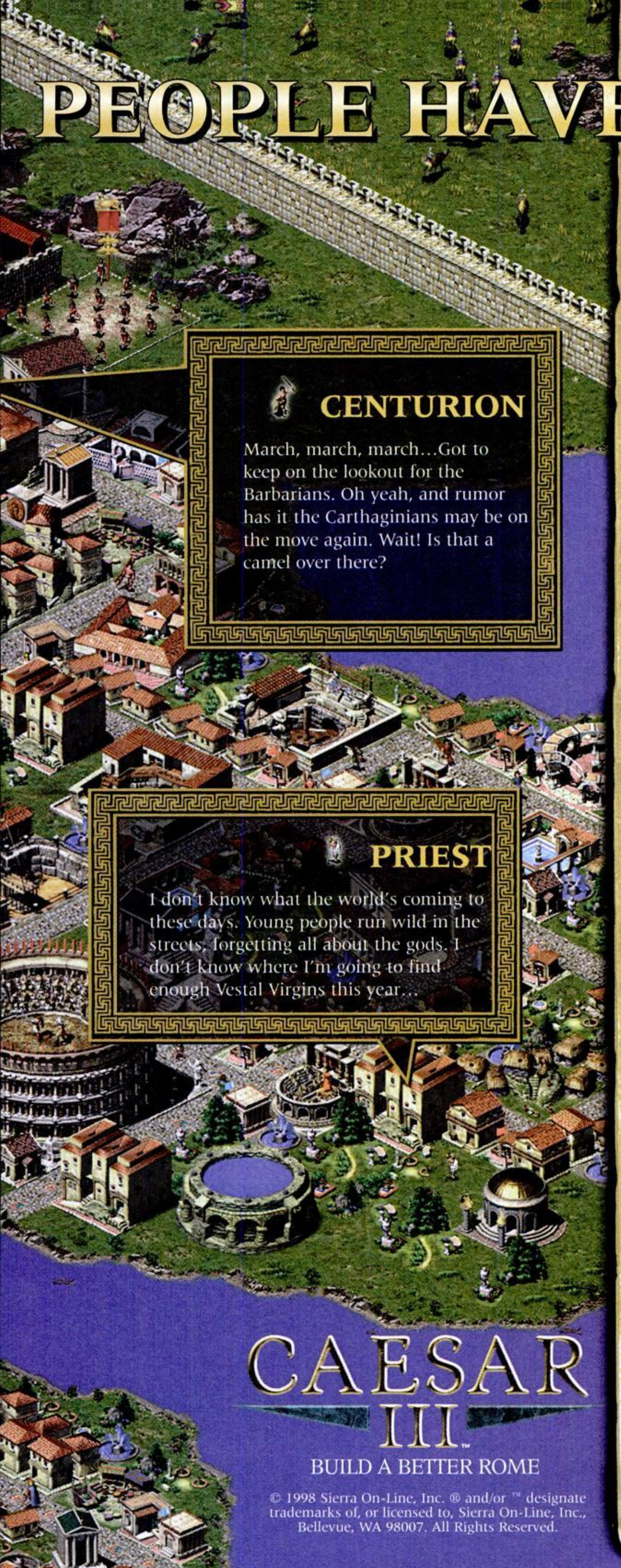
Look at this! I've got grapes rotting on the vine! With the shipbuilders on strike, I can't ship my wine to the rest of the Empire. My warehouse is full, and boy do I have a hangover...

GLADIATOR

I've got to get to the Temple of Mars to make a sacrifice before tonight's contest in the Coliseum. I think I'm losing my touch. Last night the lions nearly took my head off! If only I hadn't missed that last lesson at the Gladiator School...

CITY BUILDING SERIES
IMPRESSIONS

PEOPLE HAVE SPOKEN!


CENTURION
March, march, march...Got to keep on the lookout for the Barbarians. Oh yeah, and rumor has it the Carthaginians may be on the move again. Wait! Is that a camel over there?
PRIEST
I don't know what the world's coming to these days. Young people run wild in the streets, forgetting all about the gods. I don't know where I'm going to find enough Vestal Virgins this year...

"I find myself continually drawn back to the game to try just one more tactic... To paraphrase Shakespeare's Antony, 'I come to praise Caesar III'."

– JOHNNY WILSON
EDITOR-IN-CHIEF, COMPUTER GAMING WORLD

"A must buy for any hard core strategy fan . . ."
–IGN PC

9 OUT OF 10!
"You will find Caesar III a refreshing change from the usual shoot-em-up fare of this season. In short, 'Hail Caesar!'."
– ONLINE GAMING REVIEW

"...the Caesar series is a classic that's only getting better with age."
– GAMECENTER

CAESAR III™
BUILD A BETTER ROME

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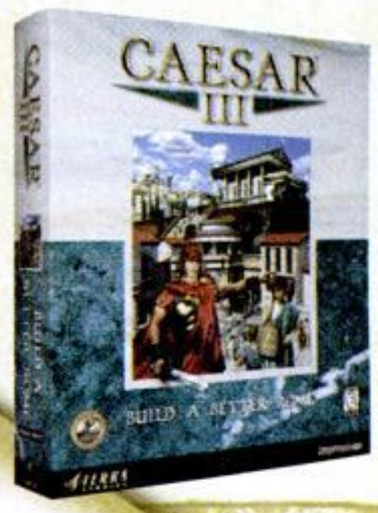

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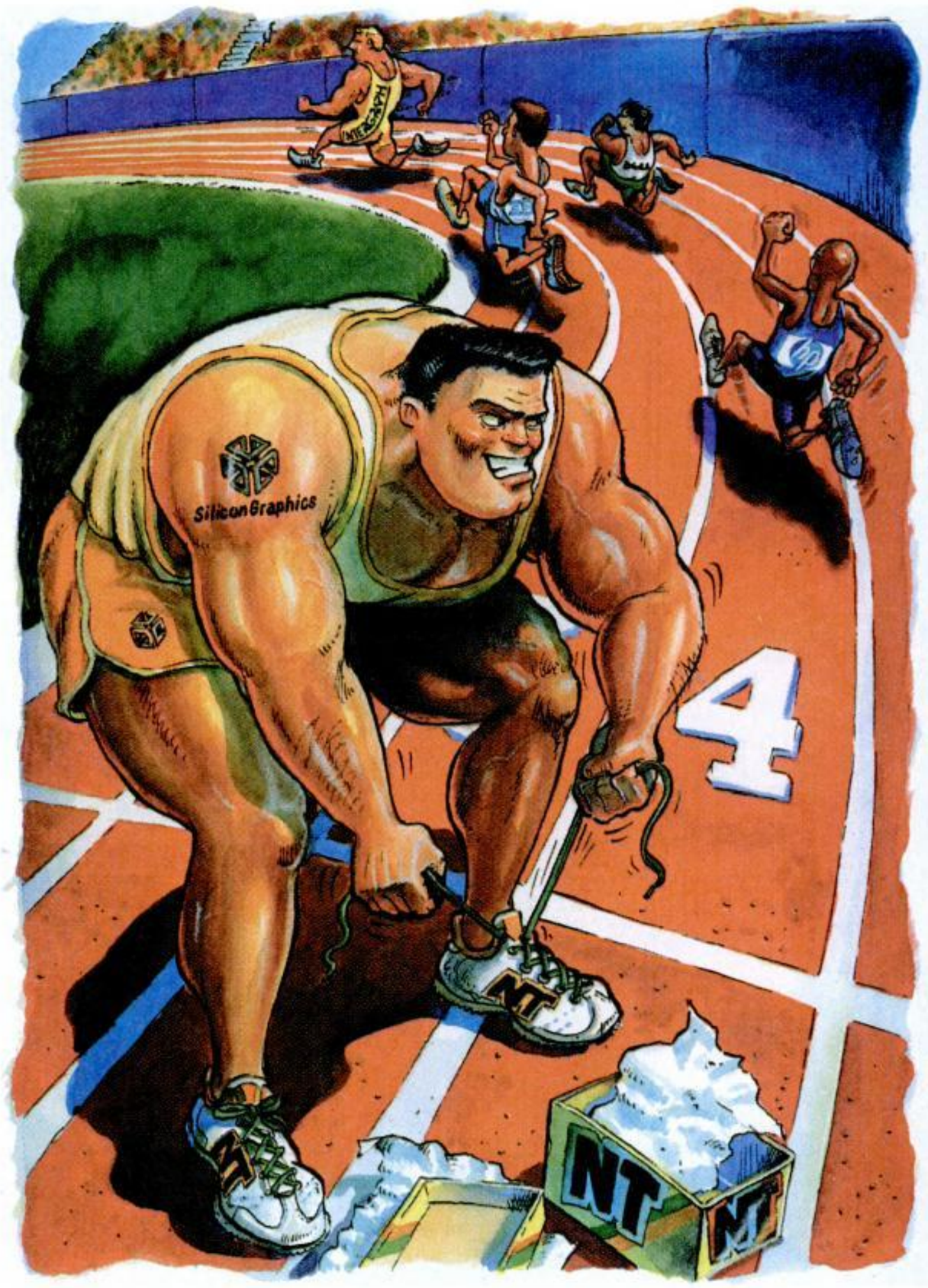
SGI Enters NT Race

Former workstation giant betting on "better late than never" strategy



Its systems are employed in the hottest special-effects and game-development houses in the world. They're used extensively with CAD applications, and you'll find them commanding most high-traffic web servers.

So why is SGI launching a new line of NT workstations?

In a word: money. Unix sales flat-lined in recent months, and most major Unix developers—such as Softimage and Alias/Wavefront—who noticed the shift in the market long ago, quietly began developing for NT. Unfortunately, the shift caught SGI completely off-guard, and with no alternative products in the channel and Sun Microsystems taking large chunks out of its Unix-server business, SGI quickly went into a financial tailspin. Hundreds of employees were laid off, the campus was closed for a few days, and SGI's stock, which had at one point hit a high of over $45, sank below $8 per share.

But in an effort to refocus the company and steer it back to profitability, SGI will launch a new line of NT workstations in February that, according to Tom Furlong, SGI's senior vice president of the Visual PC Group, "will be the fastest PCs on the planet." And while SGI promises its new NT-based workstations will deliver fast 3D performance and unheard-of expandability, SGI is pricing these new machines under $7,000—a far cry from the $50,000 to $250,000 its proprietary, multiprocessor systems currently command. However, SGI must now compete with workstation stalwarts such as Intergraph, Dell, Compaq, and Hewlett-Packard, which won't be an easy task, according to Intergraph's Jeff Edson, vice president of the Digital Media division.

"This move is late. SGI will have to jump into an already mature market, rife with ever-changing pricing pressures, business/distribution models, margins, and fulfillment channels. It's not as simple as building a product, and they will come," he said. "The workstation market is not a babbling brook; it's a raging river. They'll either swim or drown." Edson predicts SGI will do quite well capitalizing on its UNIX installed base, but he doesn't see much success outside of that.

Regardless, Furlong is confident SGI can make the switch successfully. "This workstation has been designed from the ground up," he said. By using SGI's own intellectual property in graphics and media, the

ILLUSTRATION BY SCOTT PECK

SPIN CYCLE

This month's top stories broken down ►

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
ATI Introduces New 3D Mobile Chips	ATI has announced new mobile 2D/3D graphics chips, dubbed Mobility-M and Mobility-P. The company hopes to unseat NeoMagic in the notebook market.	The tightly integrated, single-chip graphic subsystems include 4MB of SDRAM, a 2D/3D graphics engine, hardware MPEG-2 DVD decoding, and TV encoding.	"Rage Mobility does not force the industry to make the usual trade-off between performance, power, space savings, cost, and features," said a company press release.	We love ATI's current mobile chip, the Rage LT Pro, and if ATI can deliver on its promises, we won't hesitate to play *Quake III* on our notebooks.
Voodoo² Fire Sale	Guillemot is dropping the price of its 12MB Maxi Gamer 3D² to only $100. In other words, you can snag yourself dual-SLI action for a mere $200. Plus tax.	The card was originally introduced last February for $299. You do the math.	"Voodoo² continues to lead the market in 3D performance, and we expect Maxi Gamer 3D² will fly off the shelves," said Alain Pakiry, Guillemot's VP of Sales.	Price cut = too much stock. With the increasingly intense competition from products such as nVidia's TNT, it's pretty clear that Voodoo²'s lifespan may be short.

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Visual PC Group has created new silicon that includes a core chipset packed with 10 million transistors, providing a graphics pipeline more powerful than the cards in current NT workstations. SGI is specifically positioning its new workstations to CAD animators, digital-content/special-effects creators, and desktop publishers. "If the name 'designer' appears anywhere in your title, you're going to want one of these machines," Furlong said.

"I suspect they have underestimated the level of competition in the PC space. I bet they aren't going to be better than Intergraph, but they are certainly welcome to surprise me."
—John Carmack, id Software

But John Carmack of id Software, whose company uses a 16-processor SGI Origin system for its back-end processing, is a little more reserved.

"I suspect they have underestimated the level of competition in the PC space," Carmack said. "I bet they aren't going to be better than an Intergraph Wildcat system, but they are certainly welcome to surprise me," he added.

Still, it's hard to shake Furlong's confidence. He says his competitors are simply nervous that SGI has found a way to build a better PC, as opposed to clone makers who take a more "Frankenstein" approach of adding components. But Intergraph's Edson defended the "Frankenstein" approach to computer making, suggesting that SGI's high-bandwidth pipeline won't cut it with most software applications.

"The shocking reality is *we* don't rule the game, software vendors do," Edson said. "If you have the volume, they'll work hard to optimize for your hardware." When asked if SGI has an advantage in co-developing Microsoft's Fahrenheit, a new 3D API that will eventually replace OpenGL, Edson claims "all the work they've done may be useful for a short time, but everyone will have access to that technology eventually."

A source (who wished to remain anonymous) from Industrial Light and Magic, a Northern California-based special-effects post-house, doesn't think SGI has to worry about NT saving the company. In his opinion, SGI's high-end Origin servers, which have between six and twelve RISC processors apiece, are still among the fastest in the world.

"For a small 3D-production house, it might be a good idea to go to NT because they don't have nearly as much network traffic. But when you start to get into larger production venues, you have to worry about moving large film-resolution frames around a network, and for that, the only workstation I would consider using is a Unix box," he said. "The other issue is what happens to the custom scripts that many production houses use. Unless Microsoft can address this issue, NT is still not a viable platform for high-end 3D."

As for multiprocessor scalability, a major problem with current NT solutions, Furlong says they've worked out a number of problems by taking all functions—such as graphics, audio, and SCSI—off the PCI bus. However, at press time, SGI was unable to provide any concrete performance numbers.

Of course, things always look better on paper. And when SGI's stock began to tank earlier this year, the company responded by reassuring shareholders the company would be profitable by the year 2000. But Peter ffoulkes, an analyst at Dataquest, isn't sure that can, or will, happen.

"Too many things could go wrong," he said. "They're doing the right thing, but there are a significant number of hurdles. They're entering a crowded market, and SGI needs the distribution deals that many of their competitors have nurtured over the last several years. Undoubtedly, it's going to be a bumpy ride." ✹

Why SGI Is The Box-Office King

A 12-processor SGI Origin will set you back about $250,000. Producing and developing a major feature film will set you back about $50 million or so. All told, that's about $49 million more than the majority of us will ever see in a lifetime. But in case you're rigging the local lottery or expecting a family inheritance, the following list of motion pictures that have employed SGI workstations and servers during postproduction work shows how the return on investment can be very sweet indeed.

TITLE	BOX OFFICE*
Titanic	$601
Jurassic Park	$357
Forest Gump	$330
Independence Day	$306
Raiders of the Lost Ark	$242
Star Wars: Episode I The Phantom Menace	**
Twister	$242
Terminator 2	$204
Toy Story	$192
Antz	$75

* Domestic box office tally is in millions of dollars. Cumulative totals for the week ending November 8, 1998.

** Star Wars: Episode I The Phantom Menace Release Date: May 21, 1999

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to the pertinent details.

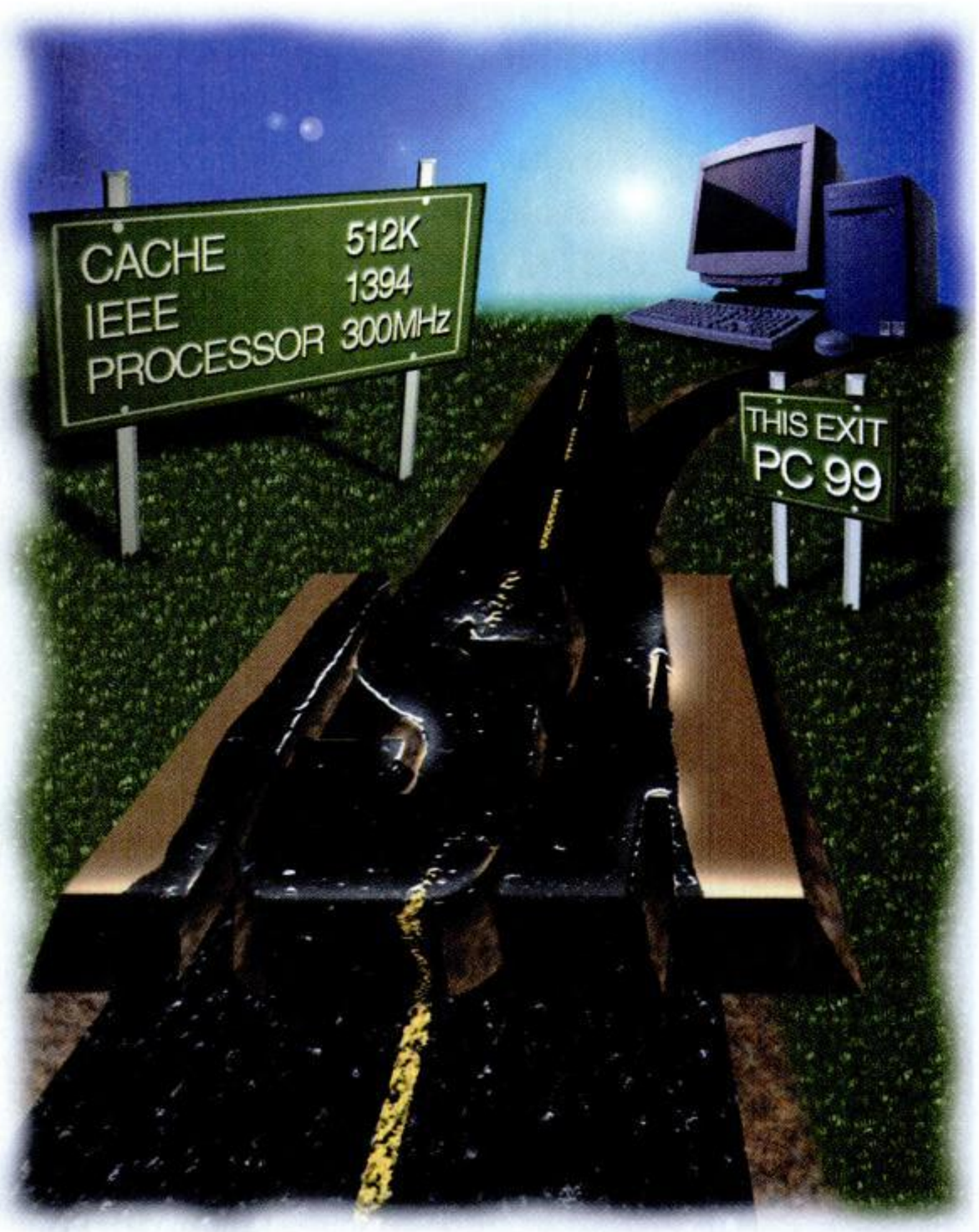
24 ▶

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
ABC News Web Site Predicts The Future	abcnews.com goofed big time when it posted U.S. election results a day early. But the dummy numbers turned out to be amazingly accurate.	ABC declared Gray Davis, Barbara Boxer, and Roy Barnes victors and predicted medical marijuana propositions would fail in Arizona and pass in Colorado—and they did.	"There was no bias intended by what we posted, and the predictions do not reflect the reporting or news judgment of ABCNews," said an ABC staffer.	Our web site—www.maximumpc.com—can also predict the future. For example: *Daikatana* will ship one day.
FCC Isn't Out To Tax Internet Access	Every year, the FCC has to fight off rumors that it plans to start taxing Internet access. Consumer groups were up in arms late this year when the rumors started flying again.	The FCC says the rumors are false. No matter what you hear, the FCC says it doesn't plan to start implementing access charges like it does for long-distance phone rates.	"This is one of the great enduring urban myths," said FCC Chairman William Kennard.	Forcing consumers to pay per-minute charges is a bad idea for consumers, but a great idea for the Baby Bells. Guess whose side we're on?

ted material

PC 99 Spec Unveiled

Paving the way for an ISA-less future



If Intel, Microsoft, and the rest of the PC industry have their way, the only ringing you'll be doing in the New Year is what you'll hear from the cash register when you buy a new system compliant with their PC 99, the annual set of industry-defined rules and technology guidelines for building new PCs.

The PC 99 spec is divided into five key sections: consumer, office, mobile, workstation, and entertainment. A 300MHz x86 processor with 128K of L2 cache is the minimum system requirement except in the mobile (233MHz) and workstation (400MHz with 512K L2 cache) environments. In its entirety, the spec comprises a 500+ page tome and covers such diverse areas as storage, communications, audio, video, and IEEE 1394. However, the single biggest design change that'll have PC fanatics dancing in the streets is the abolition of the archaic ISA slot—PC 99–spec'd machines won't contain an ISA expansion slot or any ISA-based add-on devices. Parallel and serial ports are tolerated, but PC 99 *strongly* suggests moving such devices to either USB or IEEE 1394 instead.

"More than 70% of modems and soundcards are now PCI-based, and with integrated sound solutions cropping up, ISA is no longer needed," says Adam Veder, Brand Manager of Diamond Multimedia Systems Business Unit. "By mid-1999, ISA's tombstone should be ordered, and the eulogy already composed."

In theory, the move to a PCI/AGP-only system will not only increase performance, but also lower the chances of hardware conflicts via interrupt and DMA requests. In an effort to boost USB's adoption rate, the spec calls for a minimum of two USB ports (some vendors, including Compaq, are planning on integrating up to four) and recommends joysticks and keyboards go the USB route as well. But since a plethora of USB accessories—including serial and parallel adapters—are already available (see our USB feature on page 70), the transition is expected to go smoothly.

"By mid-1999, ISA's tombstone should be ordered, and the eulogy already composed."

—Adam Veder, Diamond Multimedia

Other major PC 99 recommendations include adopting IEEE 1394 and SCSI, and adding support for Digital TV and more efficient power management via Microsoft's *OnNow* technology.

Although conforming to the PC 99 spec isn't mandatory, few are expected to resist, since all the major PC players (ranging from Compaq, AMD, 3Dfx, and Adaptec) contributed to its final definition and doing so could mean losing a competitive edge in the marketplace.

So how will you know if that new PC fully supports PC 99? Although new PC's don't require a "PC 99" moniker on the case, Microsoft is making PC 99 compliance a necessity before the company will certify any hardware for its "Designed for Windows" logo program.

For more details on PC 99, visit **http://developer.intel.com/design/**.

SPIN CYCLE

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Cable & Wireless Initiating U.S. ISP Service	When the FCC forced MCI to sell off its Internet business, Cable & Wireless snapped it up. Now the U.K-based company will offer access in more than 300 U.S. cities.	You'll get up to 150 hours of web access, web hosting, and ISDN service for only $14.95 per month and 5-cents/minute long-distance rates on weekends.	"C&W is answering the call from consumers and supplying them with the best value for their Internet dollar." said Rich Yalen, chief executive of Cable & Wireless USA.	National ISPs are becoming rare lately. Factor in some stellar long-distance rates and a lower-than-usual monthly rate, and C&W might be your ticket to the net.
Office 2000 Delayed Until Mid-1999	*Office 2000*, originally slated for release in Q1 99, will now drop back until Q2. More than 700,000 beta copies were sent out to testers last November.	*Office 2000* will add such touches as PhotoDraw 2000, Outlook 2000, stronger web integration, and Microsoft's *FrontPage* web authoring tool.	"*Office* has become the standard, and customers have said we need more time to evaluate it before it comes out," said Microsoft's Matthew Price.	Is anyone really waiting with bated breath for *Office 2000* to be released? We hope the delays will translate into fewer bugs. Who can argue with that logic?

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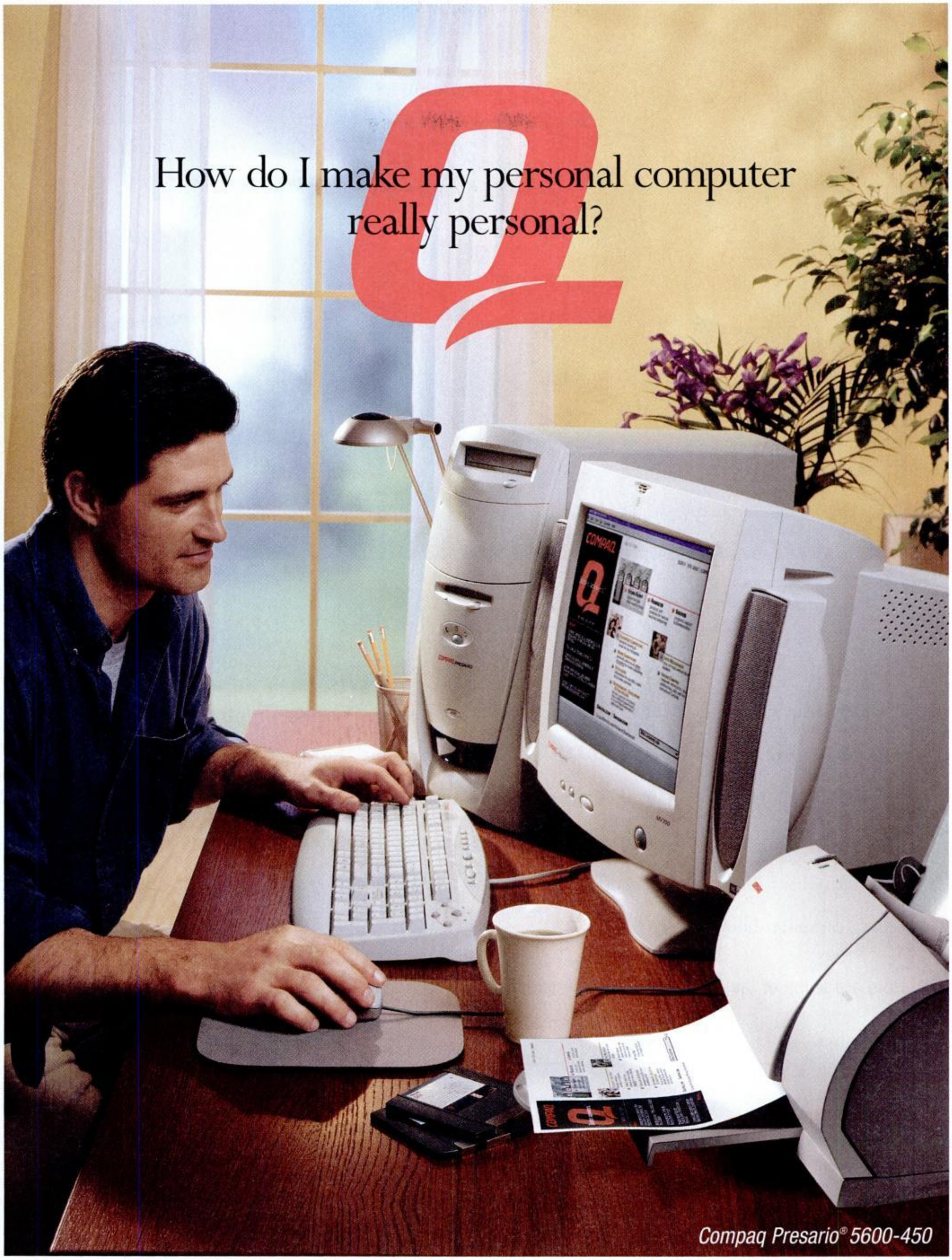

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$2,999

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- 16.8 GB Ultra DMA Hard Drive[1]
- 5X DVD-ROM Drive[5]
- 192 MB SyncDRAM expandable to 384 MB
- 1.5Mbps Digital DSL Modem (G.Lite/56K V.90)[8]
- Digital Creativity Imaging Center w/1394
- Diamond Viper 550 AGP w/16 MB SDRAM
- 10 Mbps Ethernet port, Cable Modem Ready
- JBL Pro Premium Speakers w/Subwoofer
- New! Iomega Zip Built-In™ Drive
- Microsoft® Office 97 SBE v.2.0
- Microsoft Windows®98
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- 5X DVD-ROM Drive[5]
- 128 MB SyncDRAM expandable to 384 MB
- 1.5Mbps Digital DSL Modem (G.Lite/56K V.90)[8]
- Digital Creativity Imaging Center w/1394
- Diamond Viper 550 AGP w/16 MB SDRAM
- 10 Mbps Ethernet port, Cable Modem Ready
- JBL Pro Speakers
- New! Iomega Zip Built-In™ Drive
- Microsoft Featured Home Collection
- Microsoft Windows98
- Compaq V720 17" Monitor (15.9" VIA)

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(Shown with Presario MV700 Monitor)

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- 2X AGP Graphics w/8 MB SGRAM
- 10 Mbps Ethernet port, Cable Modem Ready
- JBL Pro Speakers
- New! Iomega Zip Built-In™ Drive
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- Compaq V910 19" Monitor (18.0" VIA)

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- Microsoft Featured Home Collection
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- 10 Mbps Ethernet port, Cable Modem Ready
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- 2nd-Generation DVD-ROM Drive[5]
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WATCHDOG

▶ Maximum PC takes a bite out of bad service and gear.

Watchdog will take a bite out of those vendors who sell products that don't live up to their spec-sheet claims, those who don't honor warranty periods, and those whose customer-service personnel need to be re-taught the definition of "service." If you have a problem with a vendor that you just can't get resolved, write to us. We'll hunt them down—and trust us, our bite is worse than our bark.

BIGGER. PROBLEMS ▶

DEAR DOG In June, I signed up for lifetime Internet access with a company called **@bigger.net**. I paid the $59.95 one-time payment with my credit card, and after six weeks of waiting for the software to start my connection, I phoned @bigger.net and was told the software was in the mail. Two months later, without any software, I called to cancel. The billing department told me it had no record of a payment and asked for proof. I sent a copy of my credit-card bill and was told I'd be refunded. The credit still hasn't appeared. Have I been scammed?

—William K. Owen

THE DOG It's mostly bad news, William. @bigger.net, which sold lifetime Internet access for three Jacksons, went belly up in October 1998. Its 30,000 customers got relief through ISP Brigadoon, (**www.brigadoon.com**), which paid an undisclosed sum to pick up the customers. At press time, Brigadoon indicated it would continue to offer unlimited access to members without an additional charge.

But your case may be more complicated, William. Since your service never actually started with @bigger.net and you were awaiting a refund, you may have to apply as a creditor of bigger.net to receive a refund. While chances of recovering lost funds are slim, it's still worth filing the claim. Claim forms, which are available at your local bankruptcy court, should be filed with the U.S. Bankruptcy Court at 280 South 1st Street, San Jose, CA 95113-3099. Since you were charged for a service or product that was never shipped, you should also try to dispute the charge with your credit-card company. Generally, companies have a 120-day limit from when the goods were supposed to arrive.

COMPUTER-STAR FALLS ▶

DEAR DOG In March, I purchased a computer system from Computer-Star, which has recently changed its name to **Stargate 2000** or Millennium Technology. When the computer arrived, it did not work. I was a CIS major in college, so I knew it wasn't my fault and returned the computer for repair. It was returned to me again two weeks later, still not working. Since I was paying shipping each time, I decided just to return it for my money. According to their rules, I had only one month from date of purchase to return it. They requested I get an RMA number to return it, but refused to give me one. Since I only had three days to return it before the deadline, I sent it out anyway believing they were trying to stall me. Then I took some of my own precautions and had my credit-card company do a charge back. Now the company has flipped out and hired a collection agency to get the money out of me. I paid $1,014 for the entire system. Now that I returned it they want me to pay them $1,500. Since the merchandise was faulty, my understanding is that I do not have to pay a restocking fee. If I do, I will gladly pay it, but I will not pay more than face value for a computer I do not own.

—Jason Dickinson

THE DOG contacted a Stargate 2000 employee who identified himself as Michael Nemkov. Nemkov said Computer-Star sold its customer list and phone number to Stargate 2000 (www.sgate2000.com) in April and customers who thought they were dealing with Computer-Star were actually dealing with Stargate 2000.

Nemkov said he recalled Dickinson's case differently. He claimed Dickinson sent the machine back after the 30-day time limit was up. Stargate 2000 replaced a videocard the first time, but the second problem was caused by Dickinson, who deleted files in Windows 95, Nemkov said. After the machine was returned and the charges reversed, Stargate immediately went to its collection agency because charge backs are detrimental to the company's credit, Nemkov said. He defended the 15% restocking fee as within industry guidelines.

Nemkov said Stargate and Dickinson had just agreed to settle for the restocking fee and to close the deal entirely. He encouraged the Dog to drop the matter and not mention it in writing.

Instead, **THE DOG** bounced the ball back to Dickinson for his side.

JASON DICKINSON I have said I will pay their 15% restocking fee to settle out of court, but they will not accept that. I have proof that the computer was returned within the 30 days, and the replaced videocard did not fix the computer. The computer would not boot up. It would not even try to read the A drive. Advise your readers to get a BBB history on any company they are thinking about buying from. The company offered to remove all charges last week by having me pay a 20% restocking fee and all

STAR GATE 2000

"Now the company has flipped out and hired a collection agency to get the money out of me. "

ILLUSTRATION BY SCOTT LAUMANN

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shipping charges. I declined because they wanted me to do it over the phone on the spot without a written agreement. I don't believe I owe them anything.

Good points. THE DOG did check with the Akron Better Business Bureau and found a less than satisfying record. According to the BBB, the general manager of Stargate 2000, Igor Abramovsky, was a principle in Computer-Star, which had its Bureau membership revoked after many customer complaints. The Bureau said Abramovsky also goes by the alias David Smirnov. Up until the Bureau asked it not to, Stargate 2000 had advertised that it had been in business for 10 years. The BBB also indicates that Stargate 2000 has ties to Millennium Technology, a company that also has an unsatisfactory record. The BBB registered complaints about dissatisfaction with product, failure to ship products on time, and incorrect or partial orders. The BBB indicates Stargate did respond to problems, but some people remained unhappy.

"All the complaints have been answered," Nemkov said. "People just complain [about] everything."

Nemkov defended the company. "All the complaints have been answered," he said. "People just complain [about] everything." And just because Abramovsky worked at Computer-Star before it closed its doors doesn't mean he can't work at another business, Nemkov said. At press time, Stargate and Dickinson still had not settled their dispute. Expect an update either here or in the online edition of Watchdog (www.maximumpc.com/watchdog).

DOG TRICKS ▶

While it isn't a surefire way to check a vendor's track record, not making even a cursory call to the Better Business Bureau closest to the vendor's base of operations is just asking for trouble. The problem for many people is finding the correct BBB office. If you have web access, that's no longer a pain. At **www.bbb.com/bureaus/index.html**, you'll find a handy page that lists all the BBB bureaus and a form to locate a Bureau by zip code. Don't have the zip code of a web business you're about to pay $300 to? You probably shouldn't even do business with a company that doesn't at least list a mailing address. BBB reports are generally available by phone 24 hours a day and for free, but there may be a nominal cost with some Bureaus.

DISAPPEARING BIG DISK ▶

DEAR DOG I purchased a program called **BIG DISK** by Syncronys that essentially moves programs from your C drive and places them in your D drive. In my case, it moved my complete C drive over, then it crashed. I called tech support for three nights and approximately $75 in phone bills, but we failed to correct the problem. On the fourth night, the company disappeared. I called all the numbers I had and tried the Internet, but everything was disconnected. It cost me $200 to have the computer restored, and I still can't find them. Can you help?

—Clyde Sherrow

THE DOG Syncronys Softcorp, maker of Big Disk and the infamous SoftRAM 95, has been operating under Chapter 11 since July. You may remember SoftRAM 95 as the product that actually chewed up more RAM than it was supposed to free. Although things looked dark for you initially, the Dog was able to reach Lonna Walker, a consultant with Doyle Capital Management, which is helping take Syncronys out of bankruptcy. Walker said the company has had problems, but the entire management team had been replaced. Syncronys expects to be out of bankruptcy and operating under a new name by the time you read this, with new products as well. Walker said the new company will emphasize customer support and shed many of the dodgy titles it carried before. The name change is to lose the bad stink from the SoftRAM 95 fiasco.

A Syncronys support technician said he would contact Clyde and provided a new toll-free number—something Syncronys didn't do previously—for users to contact them. The new support number for Syncronys is 888.779.5600.

The Dog contacted Sherrow with the news, but he had already returned the product and said he was greatly dissatisfied with the company. "I bet they never call," Sherrow predicted. At press time, Sherrow said he had still not heard from Syncronys support. Let's hope it gets better. Woof.

DOG BITES ▶

THE DOG AMD was a hot topic with readers responding to Dan Creviston's problems getting satisfaction from his AMD machine in the November 1998 Watchdog column. Readers were quick to berate and defend their beloved AMD. Many urged Dan to consider looking at the chipset motherboard or his CD-ROM as the main culprits.

AMD K6-2

MICHAEL NEUMANN wrote: "I too had a problem with the K6-2/300 on an Acer motherboard. I am a reseller also. It seems there is an incompatibility problem with the 300MHz K6-2 processor and some Acer motherboards. Some of these can actually wipe out modems, CD drives, videocards, etc. I switched to an Asus P5A P5 ATX 100MHz motherboard and a Sound Blaster board that was PnP. All my troubles disappeared."

DUSTIN BEAVER was not so courteous: "I have some fine California cheese to go with Dan Creviston's whine about his K6-2. Frankly it sounds like AMD bent over backward to help. I own a 266MHz K6-2 and have never experienced any problems related to the chip."

Got a bone to pick with a vendor? Get spiked by a fly-by-night operation? Sic the Dog on them by writing watchdog @maximumpc.com. The Dog promises to get to as many as possible, but has only four paws to work with.

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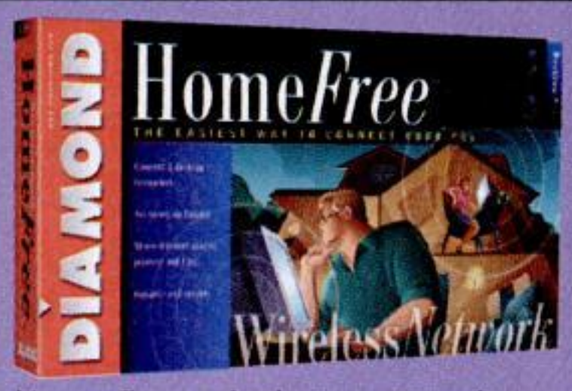

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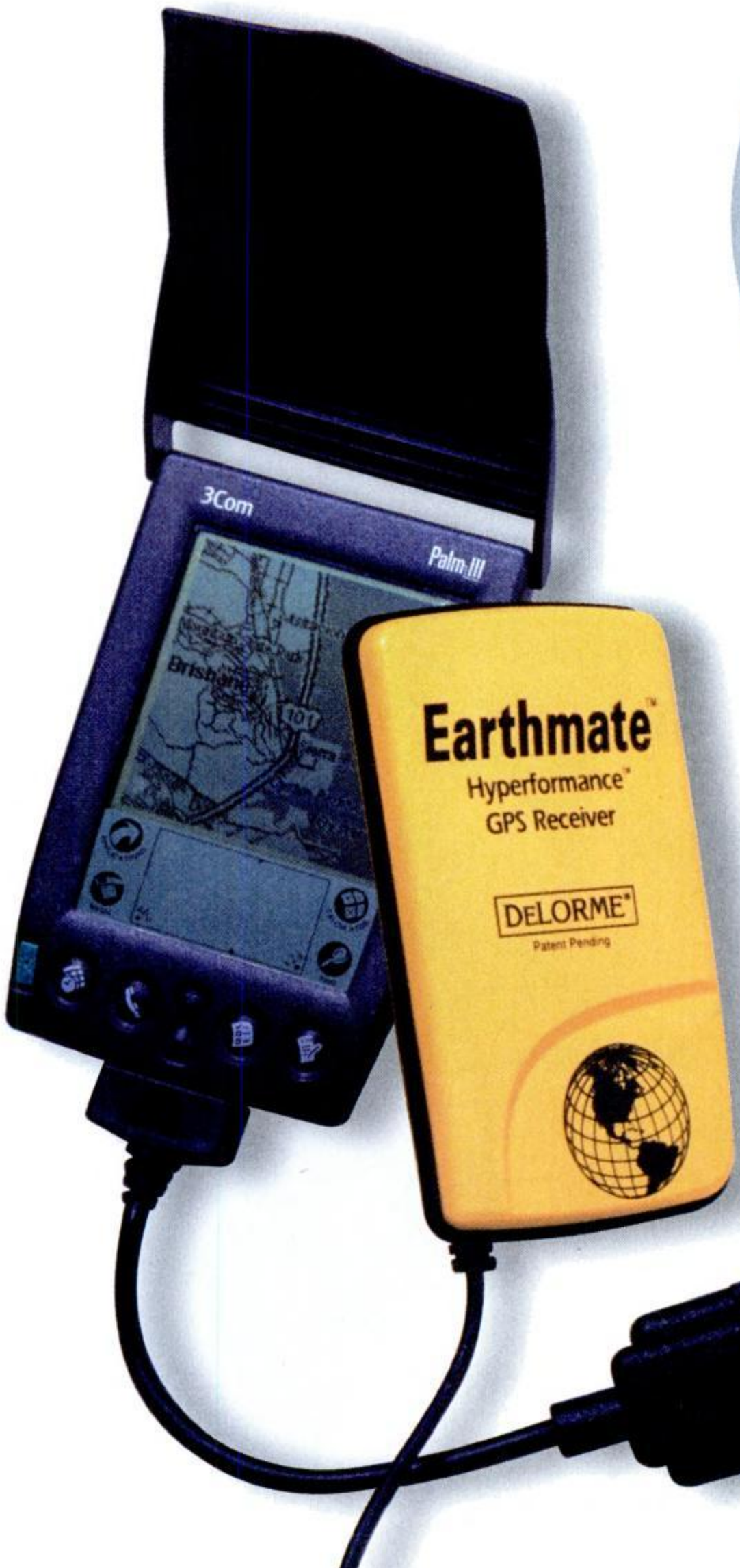

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Wherever you go, there you are. Nothing makes that point more effectively than this pocketable GPS that links to both your navigable notebook and portable PDA. Running on the latest Rockwell chipset and an integrated antenna/serial cable, the $200 Earthmate is roughly the size of the Palm III. The Earthmate links to CE-based devices and Palm's popular PDAs, and loads new maps via Delorme's *Solus Pro* software. On full-fledged notebooks the Earthmate provides the cues for street-level spoken directions via *Street Atlas USA 6.0*. **Delorme; www.delorme.com; 800.452.5931**

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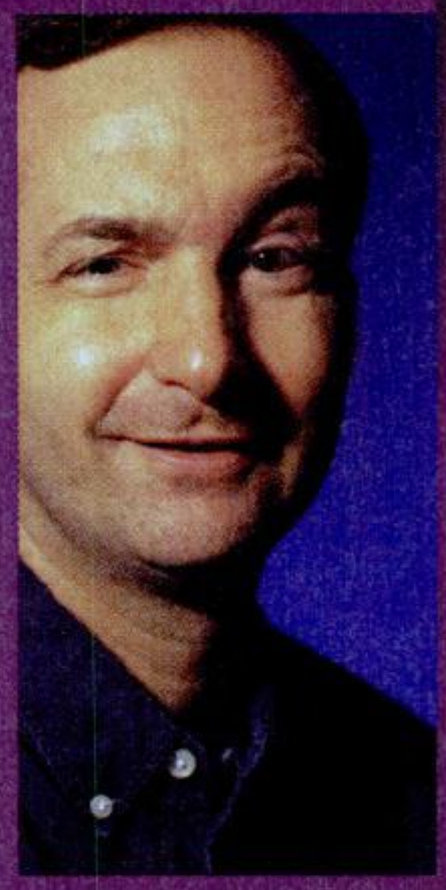

TOM HALFHILL
was senior editor at Byte magazine and is regarded as one of the most knowledgeable experts on processor technology in the industry. Contact him at **thalfhill@maximumpc.com.**

Jalapeno Burns

THE NEXT-GEN CPU FROM CYRIX LOOKS HOT

Usually I'm a "hold-the-jalapenos" kind of guy. Those hot little peppers scorch my throat, bring tears to my eyes, and burn holes in my stomach—and the undigested pieces don't feel too good coming out, either. But a new jalapeno from Cyrix might change my mind

Jalapeno is the code name for Cyrix's next-generation microprocessor core. It's the first new x86 core from Cyrix since the 6x86 (now called the M II) made its debut in 1996. The first CPU based on Jalapeno will be a highly integrated chip known as the M3. If Cyrix stays on schedule (always a challenge in the computer biz), the M3 should appear sometime around mid-2000.

Yep, that's more than a year away. Which is why we're not covering Jalapeno in-depth in this issue's Pure PC Power Preview for 1999. But this is *Maximum PC*, and we're not gonna make you wait a whole year to learn something useful we can tell you today. And Jalapeno is definitely hot stuff.

With Jalapeno and the M3, Cyrix is clearly charting a different course than its larger competitors, Intel and AMD. Those companies are designing CPUs for a wide spectrum of computing: home PCs, corporate desktops, mobile PCs, and servers. Cyrix is pursuing the consumer market. It's a lower-profit business, but the growth potential is huge, and it should allow Cyrix to fly safely under Intel's radar. While Intel doesn't like to sell CPUs for less than $100, Cyrix is targeting prices under $60. That will translate into surprisingly powerful PCs for under $500. Even if you don't buy one, someone you know will.

Cyrix was already moving in this direction before it was acquired last year by National Semiconductor, which shares the same philosophy. In 1996, Cyrix began shipping the MediaGX, which integrates a CPU core, 2D graphics, a DRAM controller, a PCI controller, 16-bit audio, and part of a core-logic system chipset. PCs based on the MediaGX don't need a graphics card, a soundcard, or a conventional system chipset. The MediaGX played a key role in the trend toward sub-$1,000 PCs when Compaq adopted it for some Presario models in 1997.

Unfortunately, the MediaGX is built around the old 5x86 core, which preceded the 6x86. Definitely not kick ass. At this point, it's more like a soft pat on the butt. With Jalapeno, Cyrix aims to bring cutting-edge performance to cut-rate processors.

Jalapeno is a fairly aggressive design by x86 standards, though not as aggressive as AMD's K7. For example, Jalapeno's superscalar core can execute two program instructions at once, while the K7 can execute three. Jalapeno can issue up to six internal operations per clock cycle, while the K7 can issue nine. Both CPUs are super-pipelined for high clock frequencies: the K7 is expected to debut at 500MHz, while Jalapeno is expected to debut a year later at 600MHz+. Both can execute instructions out of order, but the K7 has an edge in this category. Both have much-improved floating-point units (FPUs): Jalapeno has two pipelined FPUs that can handle mixed FP, MMX, and 3DNow! instructions; the K7 has three pipelined FPUs that can also handle mixed FP, MMX, and 3DNow! instructions.

Cyrix's advantage is greater integration. For starters, the M3 will add a 256K Level 2 (L2) cache to the Jalapeno core, while the K7 still needs an external L2 cache. But the M3 also integrates 3D graphics, a high-speed memory controller, and MPEG-2 decoding for DVD playback.

The on-chip 3D graphics engine can draw 266 million pixels per second or render 3 million polygons per second. It has alpha blending, fog effects, anisotropic texture filtering, and anti-aliasing. It can store textures in main memory and in the L2 cache, eliminating the need for a separate 3D graphics frame buffer. This saves money, yet should have little effect on performance. Why? Because the L2 cache runs at the Jalapeno core frequency (600MHz+) and the memory controller is a real screamer. It can transfer 3.2GB of data per second, which is four times faster than a 100MHz Super 7 bus and three times faster than AGP 4x! It's fast because it uses Direct RDRAM (Rambus DRAM), the next step beyond SDRAM.

Still, some people won't like the idea of an integrated 3D graphics engine they can't upgrade without replacing the whole CPU. Maybe a BIOS setting will allow a PCI card to override the integrated graphics. It's also likely that Cyrix will offer an M3 variant that wraps a less-integrated chip around the Jalapeno core.

Intel's K7 is expected to debut at 500MHz, while Jalapeno is expected to debut a year later at 600MHz+. At prices under $60.

But even if integrated graphics are a take-it-or-leave-it feature, the M3 should find plenty of takers. Lots of people will be thrilled to get this kind of performance in a complete system that sells for a few hundred bucks. Power users might even buy one as a second machine, just so there's less family competition for the Dream Machine. If Cyrix can deliver what it's promising, Jalapeno could burn some benchmarks in next year's Pure PC Power Preview. ✹

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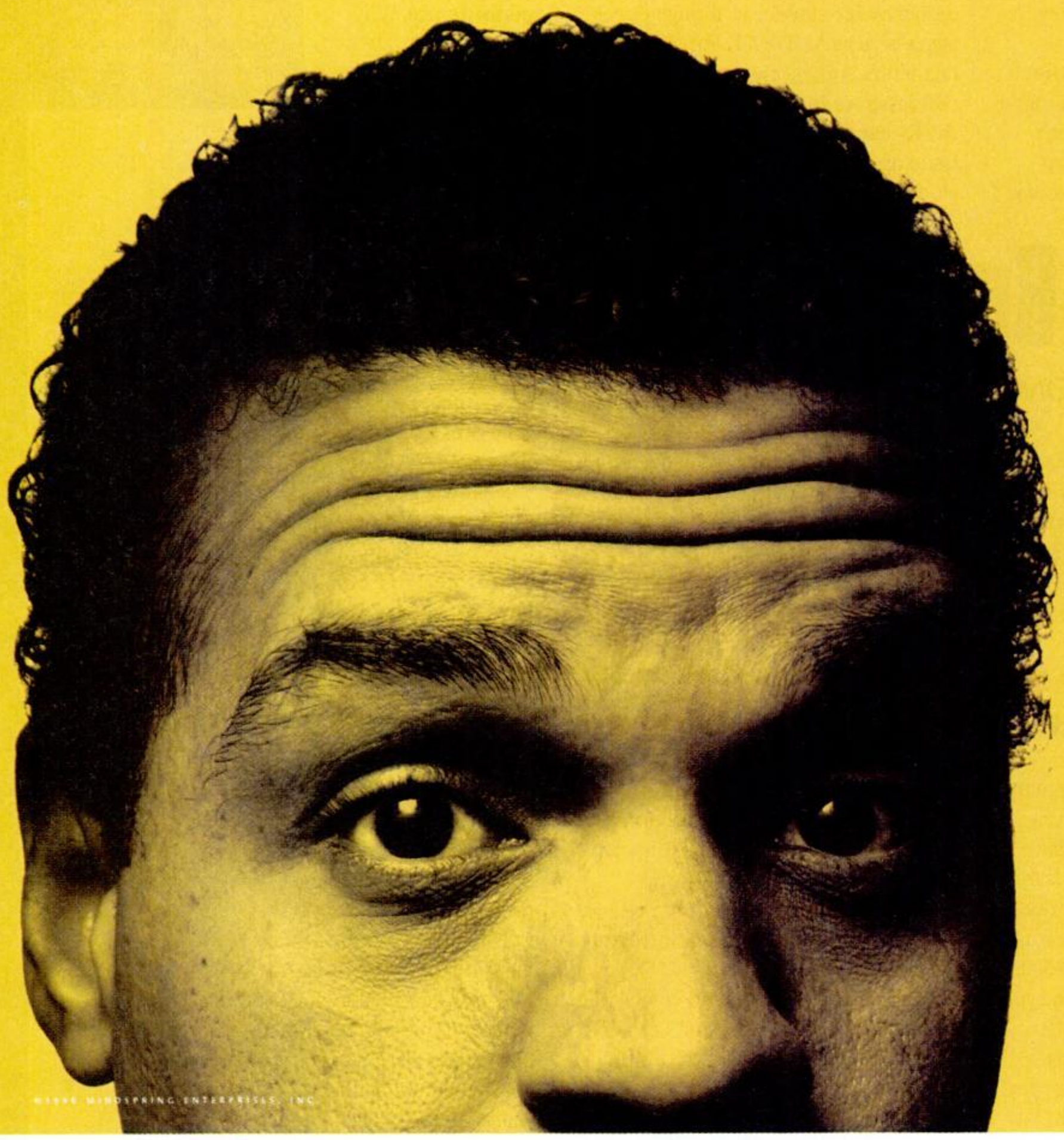
The Internet allows you to talk to people in Germany,
Russia, China and now, even customer support.



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ON THE LINE

SHEL KIMEN
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One, Two, Three, WYSIWYG

MEET A NEW BREED OF WEB EDITORS THAT DON'T SUCK

A year ago I wouldn't have been caught dead with a WYSIWYG editor on *my* desktop. It's not that I think WYSIWYG tools shouldn't exist, or that I hold some techno-elitist position that people who can't hand-code shouldn't create pages. It's because the projects I was developing were projects that other people would have to edit and maintain, and WYSIWYGs are notorious for spitting out bad, nonstandardized code.

A year has passed, and HTML is not as simple as it used to be. Between Cascading Style Sheets (CSS), Dynamic HTML (DHTML), and XML (see my November column), hand-coding HTML has gotten progressively more difficult—this makes a case to investigate WYSIWYGs. What might take 20 minutes to hand-code can sometimes take only a few minutes with a clever tool.

Thankfully, today there are a few clever tools. And sadly, there are only a few. Remember these names: Macromedia *Dreamweaver* (v1.2), GoLive *CyberStudio*, and NetObjects *Fusion 3.0*.

Besides having the marketing savvy to name a product *Dreamweaver*, Macromedia offers arguably the best WYSIWYG tool available. If you can get past the occasionally awkward interface, it's professional. Being professional, it knows you have to get through firewalls, like to customize your own macros, and see your source code as you go along. Additionally *Dreamweaver* ships with the smart *HomeSite 3.0* text editor for the PC. There's also a nifty feature that highlights the complimentary source code view when you select a portion of the WYSIWYG view, enabling you to jump from one window to the next without losing your place. If you customize the interface and take some time to understand its features, you'll have a credible tool that won't "correct" your code, for a mere $299. **www.macromedia.com**

Another cross-platform tool of merit is NetObjects *Fusion 3.0* (**www.netobjects.com**). About a hundred bucks less than *Dreamweaver*, it's a good budget option that doesn't skimp too much on functionality. While its page-layout philosophy is less than ethical (lots of tables and invisible images), overall it's pretty on track. CSS support is as strong as its DHTML support. If you want to get fancy, hook yourself up with the add-ons (which, by the way, make it significantly more expensive than the competition). The add-ons are worth it for anyone doing the Java scene and/or database integration. The bummer is this, which may not be a bummer to everyone: You don't get to tweak your raw code in the same way you do with *Dreamweaver*. It could be argued that desktop publishers don't tweak the code of *Quark XPress*. It could also be argued that building web sites is not quite the same as laying out magazine pages.

For those still plugging along on the Mac side, there's *CyberStudio* from GoLive. It has the precision of a desktop publishing tool without nagging nested tables and the notorious "clear.gif" Band-Aid. Floating palettes—the ones that Mac users are especially fond of—add to its high-quality feel, and of course GoLive has taken drag-and-drop functionality to maximum convenience—ActiveX elements, images, and drag-and-drop layout are a given. The keyframe-animation tool is solid, as is the DHTML support, but don't expect much by way of Java. (Who expects much of Java on the Mac anyway?) Some people have reported significant compatibility problems with CSS and DHTML, but I ask this: Has any hand-coder ever not had to code two separate pieces to accommodate the anomalies of *Navigator* and *Internet Explorer*? Exactly. Holding any tool responsible for the discrepancies between Netscape and Microsoft (and Sun) is, well, absurd. *CyberStudio* will run you $299. **www.golive.com**

Other possibilities to try? Sure. If you are just in love with the Microsoft way (heaven forbid), you might try *FrontPage 98* for about $140, which—as expected—slides in smoothly with all that is .doc, .xl, and .htm. And SoftQuad is hanging tight with *HoTMetaL Pro 4.0* for only $99. Hand-coders take note, *HoTMetaL Pro* is one of the few programs that won't munch your code when you open files. *Drumbeat* from Elemental Software boasts quick database-to-ASP server integration for you dynamic types, but you'll have to really work at the interface. Oh well.

Avoid Adobe *PageMill* (v3.0) and Claris *Home Page* (v3.0). You can expect a pretty wrapper (smooth-ish interface) around sloppy code and poor 4.0 generation browser support (CSS, DHTML, and Java).

When it comes right down to it, picking a WYSIWYG editor, like picking any tool, is a matter of understanding your priorities. Hand-coders want Macromedia's *Dreamweaver*. Desktop publishers want NetObjects *Fusion 3.0* or GoLive's *CyberStudio*.

And I want the world to stop using InsetCaps.

Between Cascading Style Sheets, Dynamic HTML, and XML, what might take 20 minutes to hand-code can sometimes take only a few minutes with a clever tool.

TRI

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- *COMPUTER GAMING WORLD*

.01

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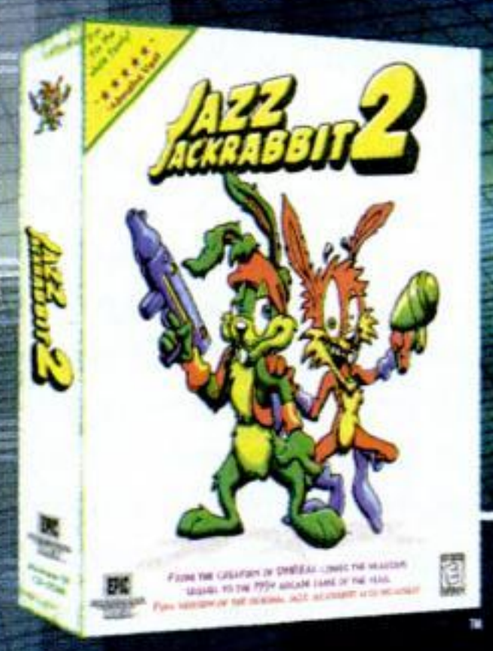

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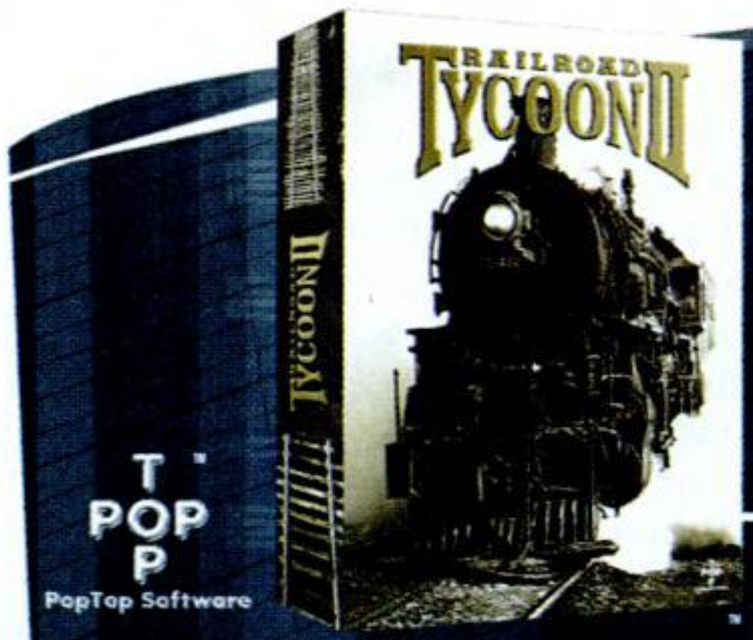

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"RAILROAD TYCOON II COULD WELL BE THE STRATEGY GAME OF THE YEAR FOR 1998."
- *INTELLIGAMER*

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GAME THEORY

T. LIAM MCDONALD
is a veteran of PC Gamer magazine and is much bigger than he looks in this picture, so keep that in mind before writing him any hate mail at **tmcdonald@maximumpc.com**.

I've discovered where all that outrage most folks are reluctant to express about the president is being directed: game companies. If my mail is anything to go by, you people are righteously pissed—and for good reason.

The flood of e-mail following my piece on personal pet peeves was the largest response to a single column that *boot* or *Maximum PC* has ever received. What I thought was a harmless Andy Rooney–esque exercise in pointless venting turned out to touch a nerve in thousands of gamers, many of whom wrote.

The most venomous mail was directed at Sierra, spurred by my passing comment that the Sierra Install Utilities deserve "a special place in hell." Trust me, I could have gone on and on about how much I detest this flotsam every Sierra game forces on my hard drive. Since I didn't, you folks did, often in language unprintable even by *our* publication.

Reader and software retailer James Puckett released a barrage of pent-up frustration that could only come from someone who has suffered through the Curse. "Nobody wants that damned thing on their system. When I recently tried *SWAT 2*, I quickly realized how lame it was and uninstalled it. I then spent the next six hours reinstalling the two dozen games that were ruined when the Sierra utility was uninstalled. I asked a regular customer if he knew of this problem. This guy is the most hardcore PC gamer I have ever met, and he said he had always had problems with the Sierra utility. He tried uninstalling *SWAT 2* to see if he would have the same problems and had to reformat his hard drive after DLLs disappeared across the board."

As a retailer, James had a very interesting perspective that Sierra would do well to take seriously. "Retribution is at hand," he wrote. "Sierra has a ton of big games out now or on the horizon, and I and most of the employees at the hundreds of stores in the chain will tell every customer who buys a Sierra product that it can easily trash the customer's system, after forcing them to install it in the Sierra directory. This is not a planned group effort, not a conspiracy against Sierra, but just the way things turned out because Sierra has screwed so many gamers who work in the goddamned stores!"

Many more letters continued in this vein, so I decided to put the issue to Sierra. After much wrangling, I finally got a response from the head of tech support. (I won't print his name, since so many readers were itching to find someone to mailbomb.) It isn't much, but here goes:

"I want to thank you for providing valuable feedback on our installer. We really do value information on how to better serve our customers. We have already initiated the changes to the directory setup and placement of the Sierra Utilities in response to this and other customer feedback. We truly hope that these changes positively enhance our customers' experiences with all Sierra On-Line products and look forward to future input from you and your colleagues."

That should make all those people with reformatted hard drives feel confident buying a Sierra product. (Let 'em know how you feel at **customer.service@sierra.com**).

This may not seem like something to get worked up about, but as with most small problems, it's indicative of larger ones. It may just be an insignificant install utility, but there is a straight line between that and exploding fuel compartments in airplanes, deadly airbags, the Space Shuttle Challenger, tainted chicken, and a conniving president. No comparison, you say? Wrong. They share the same, preventable root cause: incompetence, indifference, and outright stupidity. Would you want the people who make the Sierra utilities programming subsystems on a shuttle flight? Before you tell me that's absurd, remember that a lot of NASA people work in software development.

I wish I could have responded to everyone who wrote, but in a final, bitter irony, my e-mail utility and some associated files got nuked when some DLLs went missing. That's odd because it ran fine before I uninstalled the otherwise excellent *Half-Life*, published by The Beast Incarnate—Sierra On-Line.

Gamers Fight Back

NEWS FROM SIERRA'S SPECIAL PLACE IN GAMING HELL

"Retribution is at hand. This is not a conspiracy, but Sierra has screwed so many gamers who work in the goddamned stores!"

—James Puckett, reader and software retailer

Editor's Note: Many readers wrote in to point out that *Maximum PC* violates one of T. Liam's rules: Thou Shalt Not Ship Software Without a Jewel Case. Guilty as charged. The *Maximum CD* that ships with the deluxe edition of this magazine comes in a vinyl sleeve, which many have noted gets darned adhesive in hot and humid climes. We're looking into fixing that, but don't look forward to jewel cases. If we charged $30 like game companies do, we'd have no problem with this. But at under $8 (and only $2.50 per issue for subscribers), we simply can't afford the expense (it tacks over a dollar an issue on our mailing bill alone). Frankly, it's just more effective for you to grab a bunch of jewel cases at the corner PC shoppe, and for us to pass the savings along to you. After all, who wants a $30 magazine?

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DREAMWORKS INTERACTIVE

THE LAWS OF NATURE AND SOMEONE IS

"THE MOST ADVANCED TECHNOLOGY WE'VE EVER SEEN IN A PC GAMING TITLE!" - *COMPUTER GAMING WORLD*

PHENOMENAL PHYSICS-BASED GAME PLAY: IF IT CAN HAPPEN IN REAL LIFE, IT CAN HAPPEN HERE.

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Creative Labs' Chief Scientist, Dave Rossum, likes the sound of interactive 3D audio and the death of legacy support.

MAKING WAVES

Maximum PC How conscious of Creative Labs were you before its acquisition of your company, E-Mu?

Rossum Creative was *the* company in multimedia at that time, but for the longest time we couldn't get in the door. Around that time, we received an offer from another company to license our technology, but we had to exclude Creative from any future licensing if we were to sign. We had a couple of weeks to decide, and that sort of set a fire underneath the guys trying to get in contact with Creative. We finally tracked down Creative's COO and CFO, both of whom had home studios with E-Mu gear. They got excited, and the next thing we knew, we'd decided to deal.

Maximum PC But you're a die-hard "counter-culture" type. How did that affect your acquisition by the "corporate" Creative Labs?

Rossum Before becoming Creative's subsidiary, we had a "hired gun" CEO named Charlie Askanas, but the transition from being a company run by a couple of guys who were bootstrap types, to a company with a real Silicon Valley–experienced, well-connected, venture-capital-type CEO was pretty rough. And we lost some really good people because they just couldn't handle that transition of having to say "Yes, Sir" to a boss. Charlie made good decisions, but occasionally he'd make dumb decisions too. When we first heard Creative was interested, Charlie said "Creative will tear apart the company like a Christmas turkey, and you guys are going to be the least popular guys in Santa Cruz." And we said "Well, we at least owe it to them to listen." But much to our surprise, Sim (Wong Hoo, CEO of Creative Labs) and the other founders said, "We don't want to take apart the company or even divert its direction. When we acquire E-Mu, we want you to keep running it exactly the way you always have." That was music to our ears. And they have been very much true to their word.

Maximum PC Was Creative on the same technical level as E-Mu?

Rossum No. For example, after arriving at Creative in early 1993, I had some research in 3D audio on DAT. But the guys in Singapore didn't even have a DAT player anywhere in the company. Half of the guys at E-Mu had DAT players at their desk, and they *all* had DAT players at home. It was just shocking to realize that nobody at Creative had a DAT. Of course, they went out and bought one right away.

That was my first realization that most of the people at Creative weren't audio and music people. They did it professionally, but it wasn't their life, which is what it had been for me and most of the guys at E-Mu. I'm not a musician per se, but I love music and just really care about sound.

Creative wanted E-Mu because they saw a company that had the technology, the passion about audio, and the respect of the community.

PROFILE

And he would be...?

Dave Rossum, the founder of E-Mu Systems, is now Creative Labs' Chief Scientist. He's the guy in charge of developing soundcards and 3D audio technology.

And I would know him from...?

For years, Creative Labs was the king of ISA soundcards. But when the industry moved toward the PCI bus, Creative Labs was nowhere to be seen. Until recently, that is. Its new Sound Blaster Live! PCI product may very well represent a radical change in the way we hear our PCs into the future.

And I would care because...?

While Creative was perfecting the Sound Blaster Live!, its main competitor, Aureal, was busy gathering support for its new generation of soundcard—Vortex 2—and proprietary 3D sound technology—A3D 2.0. But with Creative now pimping its own 3D technology—Environmental Audio—along with the Live!, both companies are vying for your ears, and money.

PHOTOGRAPHY BY TIM ARCHIBALD

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

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"People need to think of sounds in terms of interactive effects, rather than prerecorded tracks."

Maximum PC What's the relationship between E-Mu, Creative Labs, and their other acquisition, Ensoniq?

Rossum All the various chip designers are integrated to the point where we can share designs with each other. We'll also criticize each other's designs and steal pieces from one another.

But Creative Labs is not an R&D organization. They're really just a sales and marketing organization. They have some engineers in Singapore for developer support and things like that, but they're more support engineers than R&D engineers.

Maximum PC Is legacy support still important these days for Creative?

Rossum It is. There are customers for whom legacy support doesn't matter at all—and that's great. I would just as soon get rid of legacy support—it's an engineering pain in the ass. But many people have software requiring legacy support, and if you buy a soundcard that doesn't have good legacy support, you've just thrown away that software. But people don't explicitly make that choice. They go out, buy a piece of hardware and then find out their software doesn't work. That's a real pain.

Maximum PC Will there ever be a time when Creative just says "enough is enough" and kills legacy support in order to move forward?

Rossum Sure, but that day is still probably 10 or 20 years off. When I joined the company in 1993, a lot of people within Creative were saying, "Sound Blaster legacy is dead," but it's hung on and on and on. I refuse to speculate how much longer it will hang on. Ultimately it's going to disappear.

Maximum PC So when will we see a consumer-grade soundcard with pro-caliber performance from Creative Labs?

Rossum As far as soundcards go, the Sound Blaster Live! is most of the way there. The SB Live! is very similar to our Emulator 4 in terms of its overall sound quality. The SB Live! uses eighth-order interpolation for its pitch shifting, actually one point higher than the algorithm used in the Emulator family. The pitch-shifting algorithm is the source of most of the distortion involved in wavetable synthesis. When you construct a sound library, you base a lot of your work around how effectively you can shift the pitch of the samples. Because the SB Live! is at least the equal of the Emulator 4, the sound libraries are easily ported over with no loss in quality.

We didn't put the Morpheus technology into the SB Live! because its complex filters are very expensive to do. SB Live! sells for an awful lot less than an Emulator 4, and that's one of the shortcuts we had to make.

The next level of filter will be a little while in coming. The thing that slows it down is less the actual technology itself than it is the market. Transistors are so incredibly cheap these days, but the percentage of the market that really wants the features for professional synthesis is very, very small. We have to get to a point where the game players and the title developers are drooling over more interactive capability on the filtering and sound. When that happens, the demand will drive the technology down in cost.

Maximum PC So you're saying there's no demand for pro-caliber technology right now?

Rossum There isn't anywhere near enough demand for that right now. We do have a long-term plan to open up the FX engine of the SB Live!, which is programmable, so developers can create their own signature or trademark FX for a particular title.

The SB Live! has a programmable DSP—a time domain FX processor—called the E-Mu 10K1. This is a very special-purpose DSP that's designed to take a stream of samples in realtime and modify them in some linear or nonlinear manner, more typically nonlinear than linear because that tends to be the interesting stuff to do. Reverberation, flanging, and fuzz pedals are the more traditional musical modifications, but the sky's the limit in terms of the weird things you can do to sounds. It's a programmable engine. And once we give developers our set of tools, people are going to have fun tinkering with the DSP. And they'll end up creating some great effects in the process. Even better, these little "modules" can be changed on the fly.

People need to be thinking of sounds in terms of interactive effects, rather than prerecorded CD or DVD tracks. The prerecorded, noninteractive sound that's become the norm is going in the wrong direction. Sure it's easy to implement, mind you, but it invariably holds back innovation. Game developers are only now beginning to realize interactive sounds are cool!

Maximum PC Of the features that invariably have to be sacrificed to make a consumer-grade product, which group did you compromise the most—gamers or musicians?

Rossum The high-end professional musician contingent at E-Mu probably thinks we keep giving things up for the gamers. But the more traditional Sound Blaster design team probably thinks we're putting all this stuff in here for the professional musician. From my point-of-view, I think we gave the musicians an awful lot of what they wanted. There's always the whiners who will want more, of course—and I say that tongue in cheek because they're the ones who make us push our limits—but from a sober viewpoint, I think we did move more toward the professional musician.

"I would just as soon get rid of the legacy

Maximum PC Was the SB Live! Creative's first PCI product?

Rossum No. In May 1995 we had a PCI wavetable product, but we didn't bring it to market because we were still making too much money off the ISA bus.

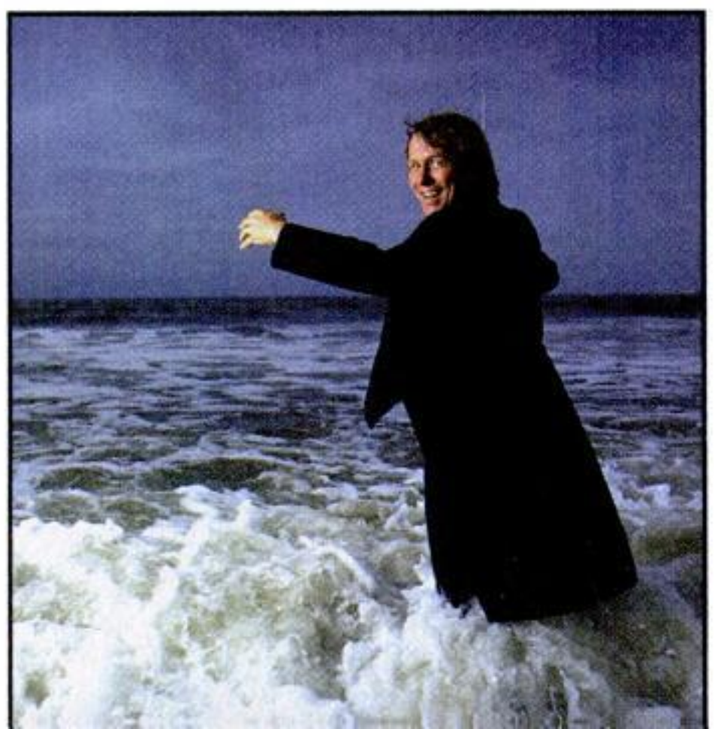
Maximum PC But one of the complaints leveled at you in the last year or so was that Creative didn't have its own PCI product. What gives?

Rossum Back in 1994, we identified the PCI bus as someplace we had to go. We put together a project internally named E-Mu 8005 that was a PCI version of the E-Mu 8000. But after looking at the marketplace, we realized it was not in our best interest to release it. It never saw, and probably never will see, the light of day as a product in itself because, in parallel, we were also beginning the development of the 10K1, which was the next generation of PCI—better, faster, cheaper.

Maximum PC Basically, Creative failed to take a leadership position in terms of driving PCI-based audio.

Rossum We were headed in the PCI direction and we knew it was the right way to go, but I certainly wouldn't debate that we aren't always in the leadership position.

My wife once gave me a picture of a flock of ducks flying toward a flagpole. In



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the center of the card, one unfortunate duck is splatted against the flagpole. The title underneath reads: "The Hazards of Leadership," which expresses where Creative was coming from in terms of the PCI bus. Being the leader is a wonderful thing when you don't get your nose bloodied *too* bad, but once in a while it's a wiser corporate strategy to let somebody else lead, while you pick up the pieces.

Besides, I'm not always right. As a technologist, I'll occasionally lead us in the wrong direction. And if you insist on this concept of: "Well I'm always the leader—follow me," you may end up going a long way in the wrong direction. There's nothing wrong with saying: "I'm a little confused right now. Let me see where the market's going and wait a while."

Maximum PC On the whole leadership thing, Aureal beat you to the punch on 3D sound. What do you think of its A3D technology?

Rossum Aureal has made a fundamental mistake trying to focus 3D sound on the physics of the environment. What they call "wavetracing" goes back to Dick Moore's work at UC San Diego at the Computer Audio Research Laboratory back in the early 1980s, which contrasts with John Chowning's work at Stanford done in the late 1970s. Chowning took a more perceptual approach to the modeling of environments, whereas Moore took a more analytical approach, where he wanted to figure out exactly what was happening from the physics of the room. Moore's work never really went far because it didn't sound as good as Chowning's.

When you talk to someone in front of you, you hear them speak and see their mouth. If they put their hands in front of their mouth, you might not be able to see their mouth, but you can still hear them. That's called drawing a straight ray. But the sound is not traveling in rays at all. Sound, like light, is a wave, but light wavelengths are much smaller than any of the common objects we encounter. Sound waves, however, range from a few inches to several feet, and when the person you're speaking to puts their hands up in front of their face, you hear a slight difference in timbre. If you close your eyes, you might be able to discern when they raised their hands because some portion of the sound of their voice has a wavelength smaller than or the same size as their hands, but there's an awful lot of it that is larger too. Anytime you have objects in your environment that are the same size as or smaller than the wavelength you're dealing with, the wavetracing algorithm completely falls apart.

Aureal has tried to go with this very analytical approach, and I think they're wasting a lot of time trying to compute things that are ultimately relatively inaccurate anyway.

Maximum PC So what makes your EAX better than Aureal's A3D?

Rossum You really need to separate the Environmental Audio (EAX) API and the underlying FX engine technology. EAX deals mostly in perceptual parameters, describing the environment not in terms of geometric and physical constraints, but in terms that

support—it's a pain in the ass in engineering."

are more familiar to the sound designer.

And EAX is so incredibly simple to use. Even at the basic level, all you have to do is go through the API and say "I'm in a cavern" and you get the generic cavern, or "I'm in a small room" and you're in a small room. We categorize those environments in our brain, so even if the dimensions of the environments being simulated are not quite right, your brain is still happy.

Maximum PC One of your competitors has stated, "EAX is really nothing more than a simple reverb model that isn't exact enough to render accurate acoustic models of 3D." What's your reaction to that?

Rossum The word I'd have to pick on is "simple." Certainly there are reverberation models in any environment. But there are really two parts to environmental sound: initial reflections and diffuse tail. The diffuse tail tells you a *huge* amount about the nature of a space. Is that a simple reverb? No, it's going to have to be a pretty complicated reverb to be any good. The initial reflections—which are wavetracing types of algorithms—try to forget about the diffuse tail, or do it all as reflections. That's equally inaccurate. We have initial reflection models and, while the presence of initial reflections are important, their accurate modeling tells you very little about your space. You can spend a huge amount of MIPS modeling these things, and if you took an oscilloscope and compared the room and the other thing—yeah, you've done an accurate job. But what happens if you play an accurate one and an approximate one, and somebody says, "those sound the same to me"?

The point that's being missed is that our technology is based around perception rather than an accurate physical model. If we want to debate the accuracy of our model to the actual physics, I give up. But if you want to debate as to which gives the better perception, I win.

"I'm not heavily concerned about soundcards disappearing, particularly with respect to USB. USB is an interface that has very limited bandwidth."

Maximum PC Creative has gone on the record as saying A3D is a closed standard while EAX is an open standard. But EAX is really just an API, and you need the proprietary hardware to run it. Will Creative license the hardware itself to other vendors or will it only be available on Creative products?

Rossum An open API is vital to make the industry grow. But if I told you everything about every parameter, I'd have to open up all my intellectual property and describe precisely what it does. We are committed to making the interface open enough so that it is fully usable, but we've also had to protect some secret stuff to maintain our advantage. We want to maintain something that we can make some money on, so we describe the API so it's fully usable, but at the same time reveal only a minimum of its functionality.

Down the road, we may license version 1.0 when we have version 2.0.

Maximum PC You support DirectSound in your EAX. What's it like working with Microsoft?

Rossum Sometimes we want to go in a different direction than they do and we work out a compromise. Rather than being on divergent strategic paths, we converged and agreed on where we were going, which is good for the entire industry.

That said, Microsoft is still this giant whose left hand sometimes doesn't know what the right hand is doing.

The frustrating thing is that Microsoft is most interested in providing a consistent platform, which is diametrically opposed to pushing the envelope. The decisions that Microsoft makes tend to fall short in terms of taking PC audio where we would like it to be. And since they're not audio people, they'll frequently do things that are just plain wrong. And when they put in software implementations, sometimes they aren't very good.

They might glare at me a little bit for saying that. But while I sometimes criticize their implementation, I very much encourage their desire to do this stuff in software and make it efficient enough that it doesn't bring the machine to its knees.

Maximum PC Intel has the AGP bus for accelerating graphics. How about an "ASP" bus to accelerate sound?

Rossum The closest thing to that is the Audio Modem Riser (AMR), Intel's latest attempt to get decent audio on the motherboard. We'd love to see AMR be a bus that really allows us to strut our stuff, but like Microsoft, Intel is more interested in the

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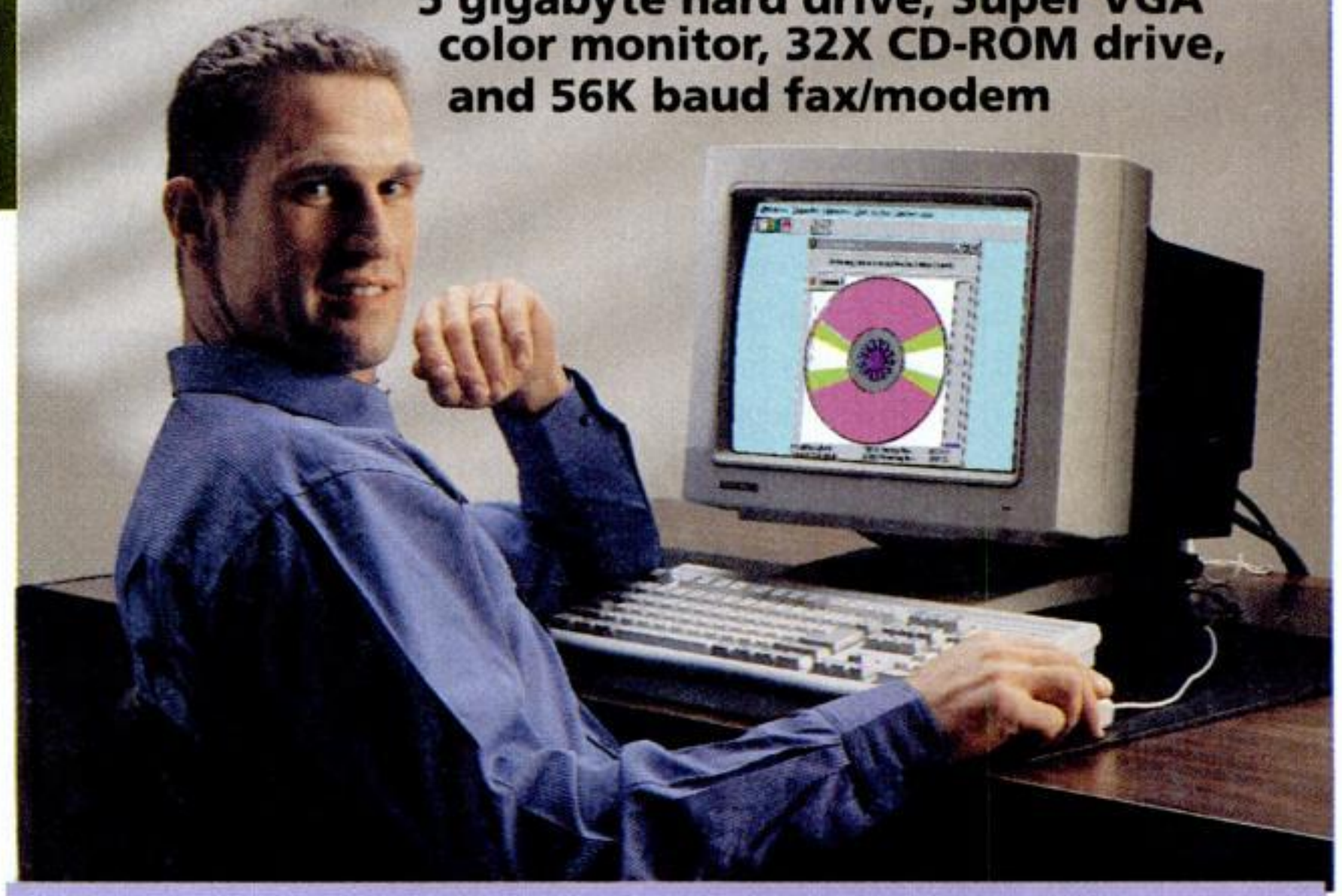

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lowest common denominator. As a result, I'm not really delighted with the AMR spec.

Maximum PC USB-based digital audio outright negates the need for a soundcard. Are you concerned about this?

Rossum We're definitely looking at it. But I'm not heavily concerned about soundcards disappearing, particularly with respect to USB. USB has very limited bandwidth. You're talking about 12 megabits per second, but when you look at usable bandwidth, it's pretty limiting. You can definitely make digital audio work over USB and come up with very reasonable scenarios where it's *obviously* broken and won't work at all.

And in-between there's going to be a compromise.

USB speakers have advantages and disadvantages over a soundcard. The advantage being that you're outside of this potentially noisy environment and the disadvantage being that you're on a long little wire with all kinds of inductives coming off the PC's power supply. And it takes MIPS away from other tasks. Anybody *really* using their computer wants those MIPS to generate the most excitement. All software synthesizers, including Ensoniq's, make substantial compromises compared to what we can do on a soundcard. At first it might sound pretty good, but if you do an A/B comparison using hardware, you'll probably exclaim, "God! How did I ever listen to *that*?"

Maximum PC But sound is very subjective—most people can't discern between A and B.

Rossum Well, education—and mis-education—are the real issues. The most important advice I can give is: Listen to your hardware and go with your emotions. And whenever possible, standardize the test you're doing. Take a piece of music that you really like and listen to it in different places and close your eyes. It's cool if you like the cheap one. And if you like the really expensive one—and you can afford it—that's wonderful too. The defining benchmark is your own ears! It's a completely subjective experience. Sound is the emotional part of the computer. It can't be an intellectual experience.

Too often people try to decide using numerical measurements. I yell at my engineers all the time because they'll substitute measuring devices for their ears. They'll produce a circuit that sounds lousy, but measures great.

Maximum PC Last year, Creative was accused of misleading customers into buying the Sound Blaster 64 at $100, which was the exact same hardware as the OEM version of the Ensoniq PCI card that sold for half that price. What happened?

"The fact that Microsoft is most interested in providing a consistent performance platform is diametrically opposed to pushing the envelope."

Rossum I don't follow retail prices or the sales channel.

Maximum PC C'mon, that's a cop out. Surely you were aware of the product?

Rossum I'm aware of the underlying technology, but under what name it goes out into the marketplace, amazingly enough, I don't follow.

Maximum PC Well, were both cards the same hardware?

Rossum I suspect they probably were. Most of the Ensoniq technology is in the software, and there's a very tight coupling between the software and hardware—that's why it's so efficient. Was there any significant difference between the hardware technologically? Probably not—but there could have been significant differences in the software.

Maximum PC So, what sorts of innovations can we expect from Creative in 1999?

Rossum You'll see a strong evolution in EAX. We're about to announce EAX 2.0, which is in response to the IA SIGS request for additional features such as occlusion models, where an object comes between the source of a sound. And expect some changes along the Microsoft standard paradigm, so developers don't have to think in two different sets of units. We'd very much like to integrate EAX in MIDI.

But SB Live! is a new flagship for us, and we'll probably ride it well into 1999. I won't say we absolutely won't introduce something new, but the typical direction with flagship products is to build upon an already successful theme. ✹

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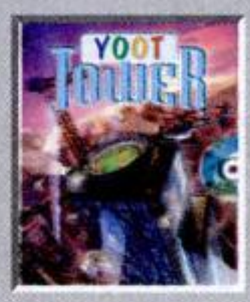

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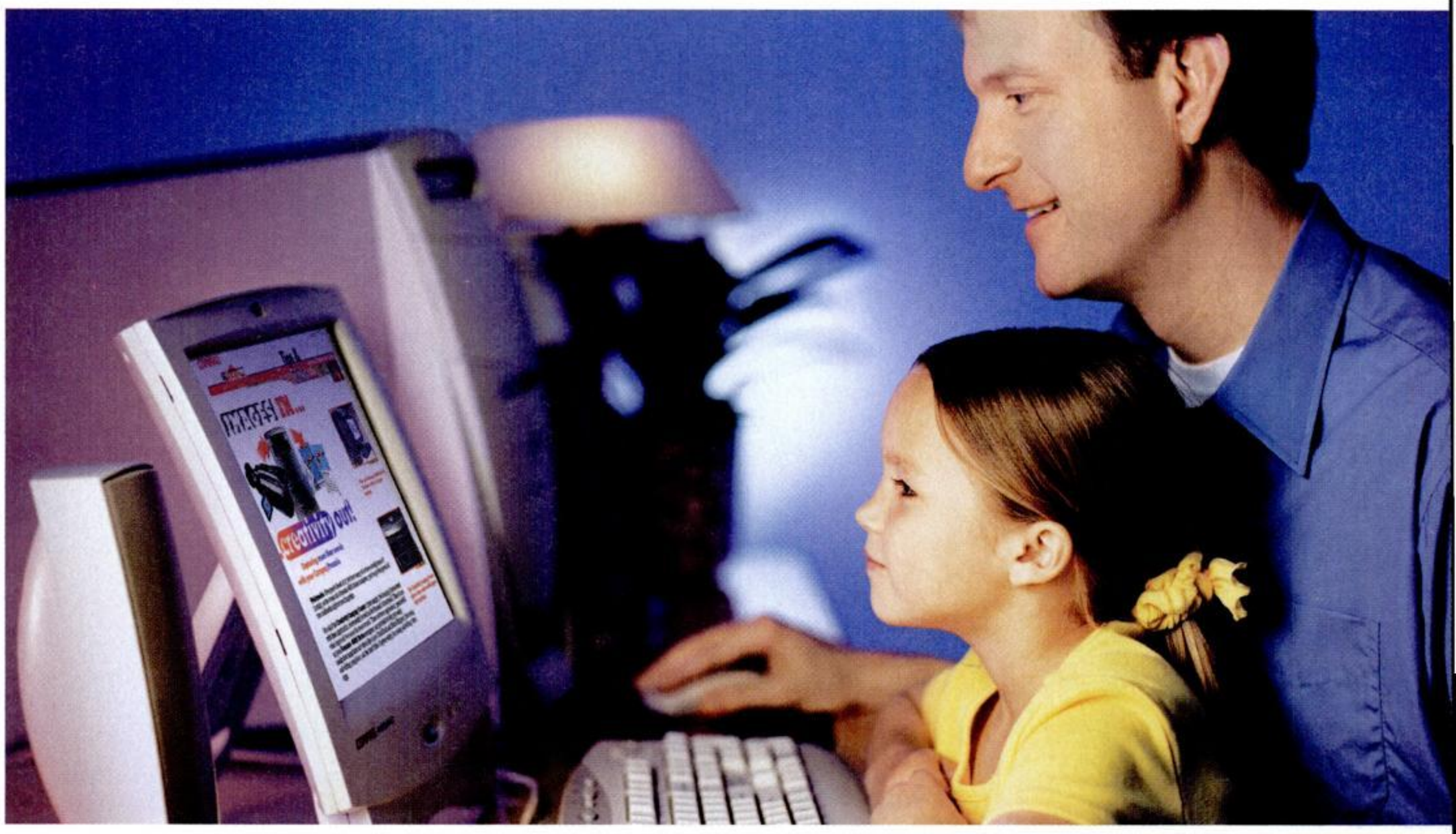

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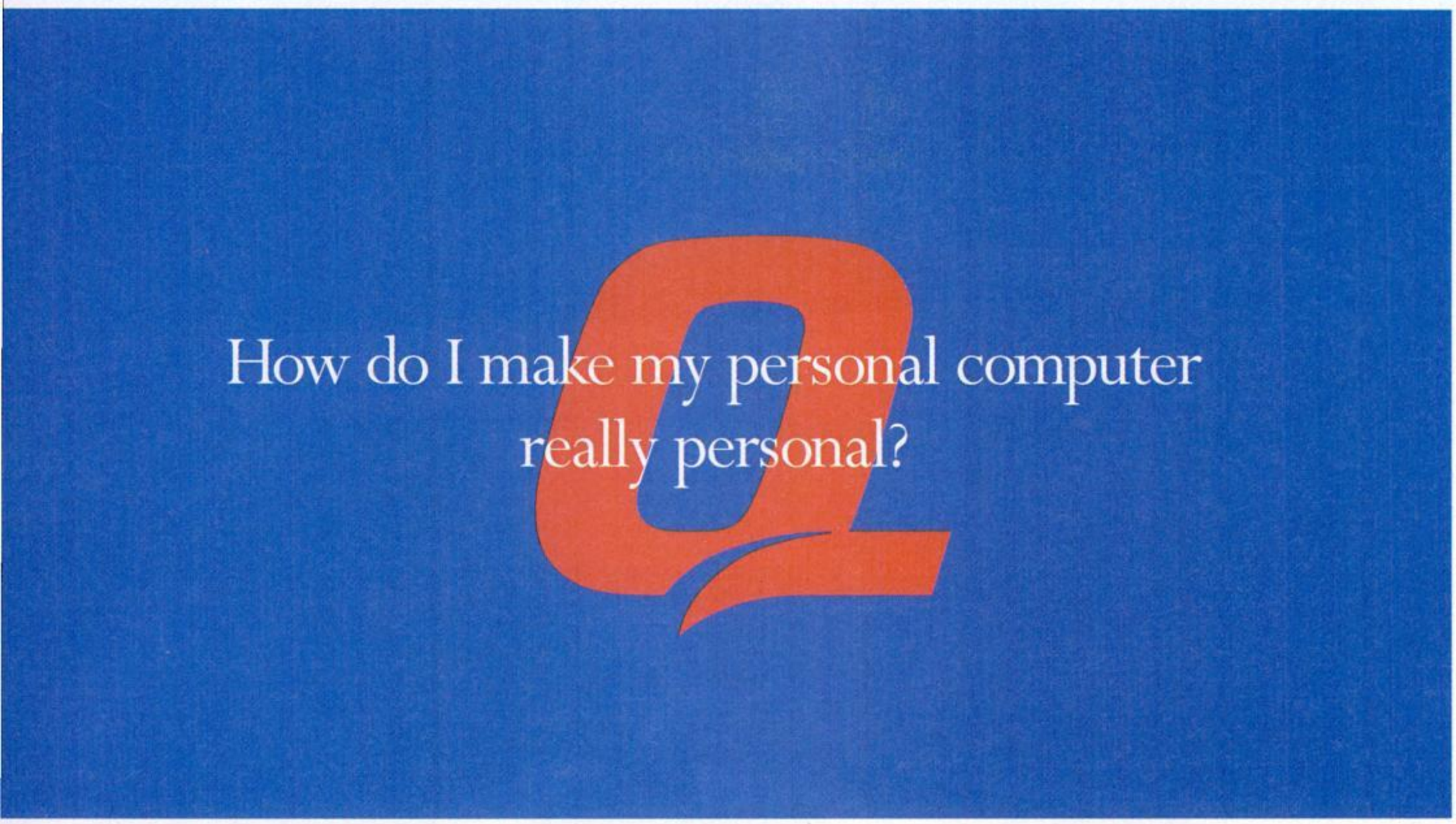

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Preview

Who can wait for the new millennium? It's time to reveal tomorrow's technologies today. Enter the Maximum PC Power Project, a covert operation to infiltrate the R&D labs of the world's hottest component companies and retrieve information on 1999's most exciting parts. We're talking technology that brazenly leapfrogs over anything you're playing with today. Freak-nasty CPUs. Ridiculously powerful 3D accelerators. DVD-ROM drives with more lasers than a KISS concert. Herewith begins our journey to tomorrow.

Processors

Pure PC Power starts with the CPU. No other chip in your system is more responsible for kick-ass performance. A feeble processor saps energy from the hottest 3D accelerator, the fastest SDRAM memory, the swiftest Ultra DMA disk drive, and the best core-logic chipset.

Fortunately, 1999 will feature a nasty grudge match between Intel and AMD that should benefit anyone looking for a high-end upgrade. Intel's latest weapon is Katmai, which we'll cover in-depth next issue. This month, we'll focus on AMD's K7, an all-new seventh-gen x86 processor that tries to leapfrog Intel's sixth-gen CPUs (Pentium Pro, Pentium II, Celeron, Xeon, and Katmai all belong to the sixth-gen P6 family). Intel's seventh-gen x86 chip, code-named Foster, isn't due until late 2000 or early 2001, which means the K7 should give AMD a jump of about 18 months.

Although Cyrix, Centaur Technology, and Rise Technology also are rolling out new x86 processors, those chips are either intended for lower-end systems or won't appear until 2000.

Don't forget what happened the last time AMD tried to ambush Intel. In 1994, AMD announced the K5, which on paper looked far more advanced than a Pentium ("K" originally stood for kryptonite—the mythical substance that could kill Superman). But initial versions of the K5 fell far short of AMD's performance goals, and by the time AMD fixed the problems, Intel had introduced the Pentium Pro and AMD suffered a humiliating defeat. The K6 got AMD back into the ring, and the K7 looks like AMD's best counterpunch yet.

No K7 systems were available to benchmark in time for this issue—we'll have definitive numbers in an upcoming issue—but here's the inside technical scoop on why AMD's new offspring looks so golden:

- The K7 is the most aggressive x86 design to date, surpassing Intel's current P6 chips in several ways. Payoff: In theory, superior performance.
- Like a P6, the K7 is superpipelined—optimized for high clock frequencies. Payoff: The first K7 chips (scheduled to ship around June) should run at 500MHz or more and easily scale to faster speeds in the future.
- No other x86 processor comes close to the K7's blazing bus speed of 200MHz. That's twice as fast as the latest high-end PCs with Super 7 sockets or Intel's Slot 1 and Slot 2 interfaces. AMD says future K7 chips could crank up the bus to an unbelievable 400MHz. Payoff: Higher performance, especially with data-hungry multimedia applications.
- Like a P6, the K7 has a separate backside bus for L2 cache. Like the Intel Xeon's L2 cache, it can run as fast as the CPU core. Payoff: By reducing traffic on the main frontside bus, the K7 avoids bottlenecks that limit performance.

57 ▶

AMD K7 55
DVD Rewritable 59
Pixels & Polygons ..61
Soundcards 64
Digital Video 66
Zen DVD 68

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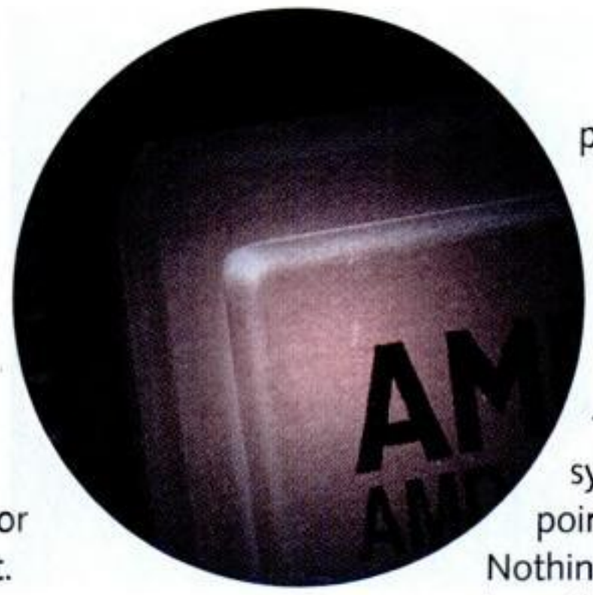
► Addressing a longstanding criticism of its current processors, AMD has dramatically boosted the capacity of the K7's floating-point units (FPUs). AMD says the K7 now has the most powerful FPU of any x86 processor. Payoffs: Faster 3D graphics and superior number-crunching power for scientific and technical applications.

AMD says the K7 now has the most powerful FPU of any x86 processor. Payoffs: Faster 3D graphics and superior number-crunching power.

► The K7 can execute as many as three program instructions per clock cycle, the same as a P6. Internally, however, the K7 is more complex than a P6 and is capable of handling nine basic operations per cycle. Payoff: The K7 should achieve its maximum instructions-per-cycle capacity more often.

► Like a P6, the K7 can change the order of program instructions on-the-fly to use internal resources more efficiently. The K7, however, carries this technique to an unprecedented level for an x86 processor. Payoff: Again, this should help the K7 achieve its maximum possible performance more often.

► New CPU interface. AMD is legally forbidden to clone Intel's slots, and the Super 7 socket is too slow for the K7—so AMD designed Slot A, which physically resembles Intel's Slot 1, but is electrically incompatible. Payoffs: CPU daughtercards are easier to replace than socket-based CPUs, and motherboard manufacturers that are already making Slot 1 boards won't have to do significant retooling to support the Slot A interface. Drawback: AMD must rely heavily on motherboard, BIOS, and chipset vendors for industry-wide support.



Intel's biggest threat yet.

Inside the K7

AMD's biggest accomplishment is the sudden leap to a 200MHz system bus (don't confuse this with the K7's core clock frequency, which will be around 500MHz). The speed increase is important because the system I/O bus, or frontside bus, is a critical path that often becomes a frustrating bottleneck. In current K6 systems, all data that flows between the CPU, L2 cache, core-logic system chipset, PCI devices, AGP card, and main memory has to travel over the system I/O bus. That's a lot of traffic. To make things worse, CPU chips are getting much faster than RAM chips, so main memory can't keep the CPU fed with data.

For five long years, PC system buses were stuck at 66MHz. Boring. In mid-1998, Intel's Deschutes-series P6 chips and AMD's Super 7 socket boosted the bus frequency to 100MHz. That's better. But the K7's 200MHz system bus is another 100 percent faster than that. How is such a leap possible?

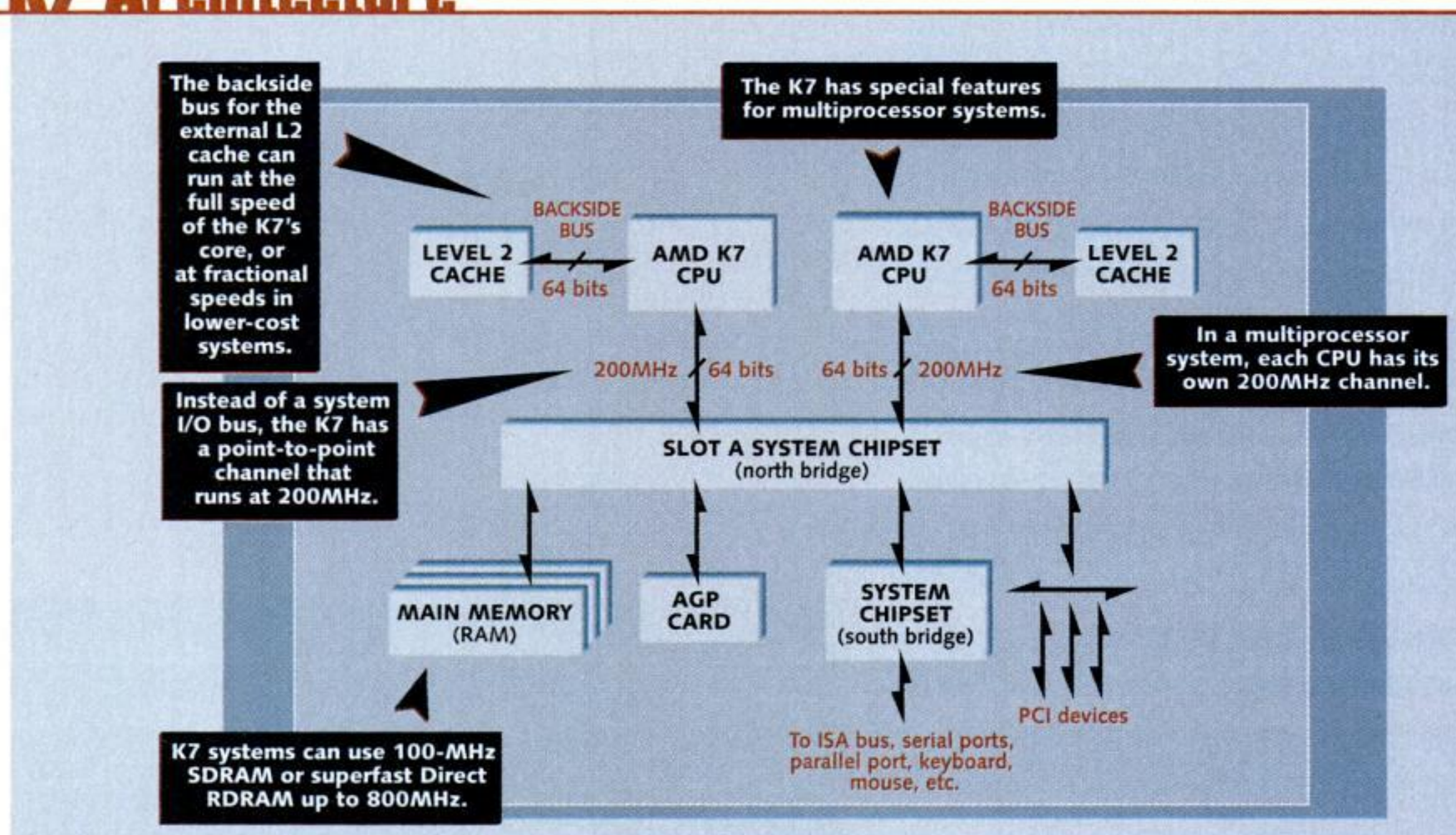
To begin with, it's not really a bus. Technically, a bus is a multidrop pathway that's shared by multiple devices, such as those mentioned above. In a K7 system, the CPU talks directly to the system chipset over a point-to-point channel. Nothing else is allowed to share that channel. All other devices communicate with the chipset over separate interfaces (see the K7 System Architecture diagram below).

At its initial speed of 200MHz, the maximum throughput of the K7's I/O channel is 1.6GB/sec, which is twice the capacity of a P6 or Super 7 bus. (To calculate bus capacity, multiply the bus frequency by the bus width. In this case, the bus is 64 bits wide, so it transfers 8 bytes per clock cycle times 200 million cycles per second—which equals 1.6GB/sec.) Future K7 chips could double that capacity again by driving the channel at 400MHz. Intel's P6 bus will creep up to 133MHz soon, but still falls well short of the K7.

AMD licensed this wicked-fast interface from Digital, which designed it for the Alpha 21264 RISC processor. It gives the K7 plenty of headroom to grow. It also allows vendors to build speedy K7-based servers, which need more I/O bandwidth than desktop PCs. This is a signal that AMD wants to challenge Intel in the higher-profit corporate market as well as the high-volume consumer market.

As a side effect, the cross-pollina-

K7 Architecture


The backside bus for the external L2 cache can run at the full speed of the K7's core, or at fractional speeds in lower-cost systems.
The K7 has special features for multiprocessor systems.
BACKSIDE BUS
LEVEL 2 CACHE
64 bits
AMD K7 CPU
AMD K7 CPU
BACKSIDE BUS
64 bits
LEVEL 2 CACHE
In a multiprocessor system, each CPU has its own 200MHz channel.
200MHz
64 bits
64 bits
200MHz
Instead of a system I/O bus, the K7 has a point-to-point channel that runs at 200MHz.
SLOT A SYSTEM CHIPSET
(north bridge)
MAIN MEMORY
(RAM)
AGP CARD
SYSTEM CHIPSET
(south bridge)
PCI devices
To ISA bus, serial ports, parallel port, keyboard, mouse, etc.
K7 systems can use 100-MHz SDRAM or superfast Direct RDRAM up to 800MHz.

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Katmai Redefines the x86

Intel hasn't revealed everything about Katmai yet, but enough details have trickled out to mark the CPU as a significant improvement over existing P6-series processors. We'll have a full preview next month, but for now, we'll just mention Katmai's most surprising feature: new registers for the processor's 70 new multimedia instructions.

The eight new registers redefine the 20-year-old x86 architecture and require operating-system changes to maintain full compatibility (Intel says Win98 is already compatible). Another surprise is that the registers have twice the capacity of 3DNow! registers, but Katmai won't take full advantage of them.

Each of Katmai's 128-bit registers can hold four single-precision floating-point (FP) values, which are extremely useful for 3D graphics. That's twice as many FP values as the 64-bit 3DNow! registers can hold. But because Katmai has essentially the same FP unit as current P6 processors, it can execute only two, not four, FP operations per clock cycle. That means Katmai isn't really any faster than 3DNow!, even though Katmai enjoys a theoretical two-to-one advantage. Future Intel CPUs beyond Katmai will probably have stronger FPUs that can handle all four values in one cycle.

Technically it's easy to add registers—what's a few thousand more transistors on a chip that already has millions? However, probably only Intel could get away with redefining the x86 architecture in this way, and probably only Intel has the clout to get Microsoft and other companies to modify their operating systems to accommodate it.

Another contender for Pure PC Power is Cyrix, which recently revealed details about its new Jalapeno core and M3 processor. But the M3 won't ship until 2000, so it must wait until next year's preview. (For an early peek at Jalapeno, see this month's Fast Forward column on p. 37.)

Centaur Technology and a newcomer, Rise Technology, also are unveiling new x86 chips. Centaur's WinChip 4 is based on a new CPU core optimized for high clock speeds and is expected to debut in the second half of 1999 at 400MHz to 500MHz. Rise's mP6 is optimized for low power consumption and is intended for notebook computers and basic desktop PCs. Production began in late 1998, and systems should appear in the first half of 1999. These CPUs are aiming at low- to mid-range systems, not Pure PC Power. Still, they'll be perfectly respectable CPUs for many users, and we'll be covering them in detail in future issues.

Finally, power users who haven't yet invested in a Slot 1/Pentium II system and can't wait for K7 might want to check out AMD's Socket 7–compatible K6-3, which should debut early this year. Like Intel's Pentium II–based Mendocino, the K6-3 features on-die L2 cache running at full processor speed—but AMD's CPU boasts 256K of L2 compared to Mendocino's 128K. Look for K6-3 to launch at 450MHz. *—TH*

tion between the K7 and the 21264 means that Slot A motherboards could theoretically work with either type of CPU, though of course they still can't run the same software. This probably has more advantages for Digital than for AMD—Digital needs lower-priced motherboards for the Alpha.

The K7's extraordinary bus bandwidth doesn't stop with the 200MHz system I/O channel. It also has a separate backside bus for the external L2 cache, just like a P6. The bus is 64 bits wide, and can run at different frequencies for different purposes. For instance, lower-priced consumer systems can use pipeline-burst Static RAM (SRAM) chips that run at a fraction of the CPU's core frequency and are relatively inexpensive. That's how most Pentium II chips work.

In higher-end systems, the K7 can use late-write SRAMs or new Double-Data Rate (DDR) SRAMs that cruise at the full core frequency—500MHz or faster. The K7 can address up to 512KB of L2 cache without any external tag RAM chips. With external tags, it can address up to 8MB of L2 cache. That's way more cache than a desktop PC needs, which is another signal that AMD is aiming the K7 at servers.

Yet another clue to AMD's ambitions is the K7's support for symmetric multiprocessing (SMP). The K7 has features that make it easier for multiple CPUs to share memory. Each CPU would get its own high-speed channel to a special system chipset. Payoff: The K7 won't limit system designers in ways that the K6 does. If your personal Dream Machine is a two-way SMP box with 8MB of L2 cache per CPU and DDR-SRAMs that scream at the full core frequency, Intel is no longer the only game in town.

Fast to the Core

Internally, the K7 should achieve its theoretical maximum performance more often than a P6 (virtually all CPUs fall short of their theoretical performance most of the time). Although many of the K7's improvements are too esoteric to describe here in detail, we'll touch on three of the most interesting features: the hybrid CISC/RISC core, the provisions for out-of-order execution, and the buffed FPUs.

Like most x86 processors, the K7 has a decoupled microarchitecture. This is a way of adapting modern RISC principles to older CISC architectures like the x86. Essentially, the CPU converts unwieldy CISC instructions into more streamlined RISC-like instructions, which are called ROPs (RISC operations) in the K7. The conversion happens internally so the CPU remains compatible with existing software.

Internally, the K7 should achieve its theoretical maximum performance more often than a P6.

To help this along, the K7 has three instruction decoders that are more sophisticated than their P6 counterparts. The decoders prepare each program instruction for the function units that execute the ROPs. Payoff: The K7 should stall less often when confronted with difficult program code, especially in multimedia applications.

Another benefit is that ROPs flow more smoothly through superscalar pipelines. Under ideal conditions, the K7 can execute as many

59 ▶

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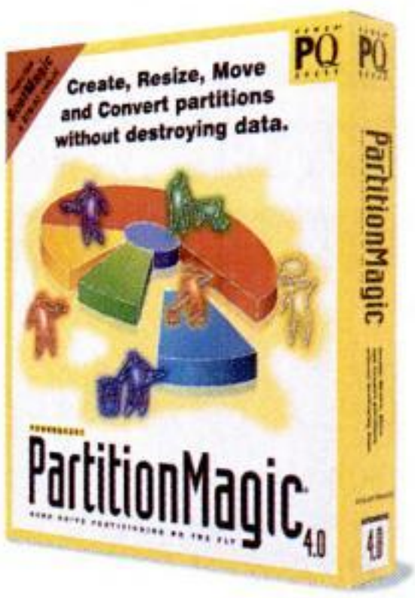

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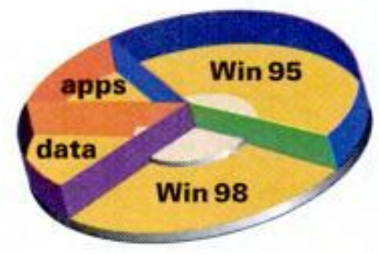

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AMD vs. Intel

	AMD K7	PENTIUM PRO	PENTIUM II	CELERON	XEON	AMD K6-2
x86 Generation	7th	6th	6th	6th	6th	6th
CPU Interface	Slot A	Socket 8	Slot 1/Slot 2	Slot 1	Slot 2	Socket 7/Super 7
Core Clock Speed*	500MHz	to 200MHz	to 450MHz	to 333MHz	to 450MHz	to 350MHz
System I/O Bus	200MHz	66MHz	66/100MHz	66MHz	100MHz	66/100MHz
L1 Cache (i-cache/d-cache)	64K/64K	16K/16K	16K/16K	16K/16K	16K/16K	32K/32K
L2 Cache	External	External	External	Integrated**	External	External
L2 Backside Bus	Yes	Yes	Yes	Yes	Yes	No
L2 Bus Speed	to core speed	core speed	1/2 core speed	core speed**	core speed	Not Applicable
Superscalar Execution	9 ops	5 ops	5 ops	5 ops	5 ops	6 ops
Reorder Window	72 ops	40 ops	40 ops	40 ops	40 ops	24 ops
Superpipelined	Yes	Yes	Yes	Yes	Yes	No
Pipeline Stages	10	12-14	12-14	12-14	12-14	7
MMX	Yes	No	Yes	Yes	Yes	Yes
3DNow!	Yes	No	No	No	No	Yes
Transistors	22 million	5.5 million	7.5 million***	7.5 million***	7.5 million	9.3 million
Ship Date	mid-1999	1995	1997	1998	1998	1998

* CPUs will be running at faster clock speeds by the time the K7 ships. **At presstime, only the "Mendocino" Celeron has an integrated L2 cache that runs at the core speed. The transistor count omits the L2 cache. ***Deschutes series.

as nine ROPs per clock cycle. To achieve this target more often, the K7 can execute the ROPs out of order—the CPU actually changes the order of a program's instructions while the program is running. Other x86 processors do this too, but the K7 beats them all. It can juggle as many as 72 instructions while deciding how to rearrange them. That's almost twice as many as a P6, which can juggle 40, and it's more than any other current CPU except for the Alpha 21264, which can juggle 80.

While all this out-of-order execution is happening, the K7's FPUs are blazing away. They can handle as many as three instructions simultaneously, and two instructions can be a mix of MMX, 3DNow!, or 80-bit math operations (the third operation must be a store). The maximum throughput at 500MHz is 1GFLOP (1 billion FP operations per second) with 80-bit FP instructions, or 2GFLOPs with MMX or 3DNow! multimedia instructions. That's twice as potent as current P6 chips, and it matches Katmai's expected performance at 500MHz. Payoff: AMD is no longer a floating-point also-ran.

Uncertain Future

Ultimately, the K7's success depends not only on raw performance, but also on how widely the industry embraces it. The K7 and Slot A require special motherboards, BIOS chips, and system chipsets. AMD says major vendors of all these components are supporting the K7, though only ALi and VIA have announced chipset support at presstime.

AMD must also avoid the early production and performance problems that stunted the K5 and K6. One break is that the K7 will debut on a 0.25-micron fabrication process that's already working smoothly for the K6. AMD won't face the potentially difficult transition to a new 0.18-micron process until later in 1999.

Based on what we know today, the K7 should beat Intel's current processors and at least reach parity with Katmai—a remarkable comeback for AMD. It ain't kryptonite, but it ain't chopped liver, either.

—Tom R. Halfhill

MAXIMUMPC.COM *For a quick primer on understanding CPU architectures, read our processor white paper at* **www.maximumpc.com**.

61 ▶

DVD-RW Draws Lines of Demarcation

Aiming to render CD rewritable and other removable storage solutions obsolete, some type of mega-capacity DVD rewritable technology will emerge in 1999. Unfortunately, all three DVD rewritable front runners are fraught with question marks.

DVD-RAM drives from Hitachi, Panasonic, and Toshiba are already available in the $500 to $700 range. Media capacity currently tops out at 2.6GB.

Unfortunately, current DVD-RAM media is so fragile, even fingerprints can screw up reads and writes. To beat the problem, the media is encased in non-removable protective cartridges—which means you can't insert DVD-RAM into currently available DVD-ROM drives. By the end of 1999, we hope to see second-gen DVD-RAM technology that ups capacity to 4.7GB and ditches the cartridges. And in early 1999, we should see DVD-ROM drives that contain tray-loading mechanisms to support DVD-RAM.

When it's released sometime in the second half of 1999, Sony's DVD +RW technology will offer 3GB/6GB capacity on single-/double-sided media. Like DVD-RAM, the first generation of DVD +RW media will use protective cartridges, but Sony says the media itself will be removable for playback in compatible DVD-ROM drives (no word yet on specific drive compatibility or whether firmware updates will address compatibility issues). Sony says its DVD +RW drives will cost "well below" $1,000.

A third rewritable standard, Pioneer's DVD-RW, will burn both rewritable and one-off DVD-ROM discs. That's right: full compatibility with existing DVD-ROM drives, making the technology much like the CD-R/RW spec in the CD-ROM world. DVD-RW drives will start appearing in early 1999 in the $3,000 to $5,000 price range. The second generation should bring DVD-RW within the consumer's grasp sometime in 2000. *—Sean Cleveland*

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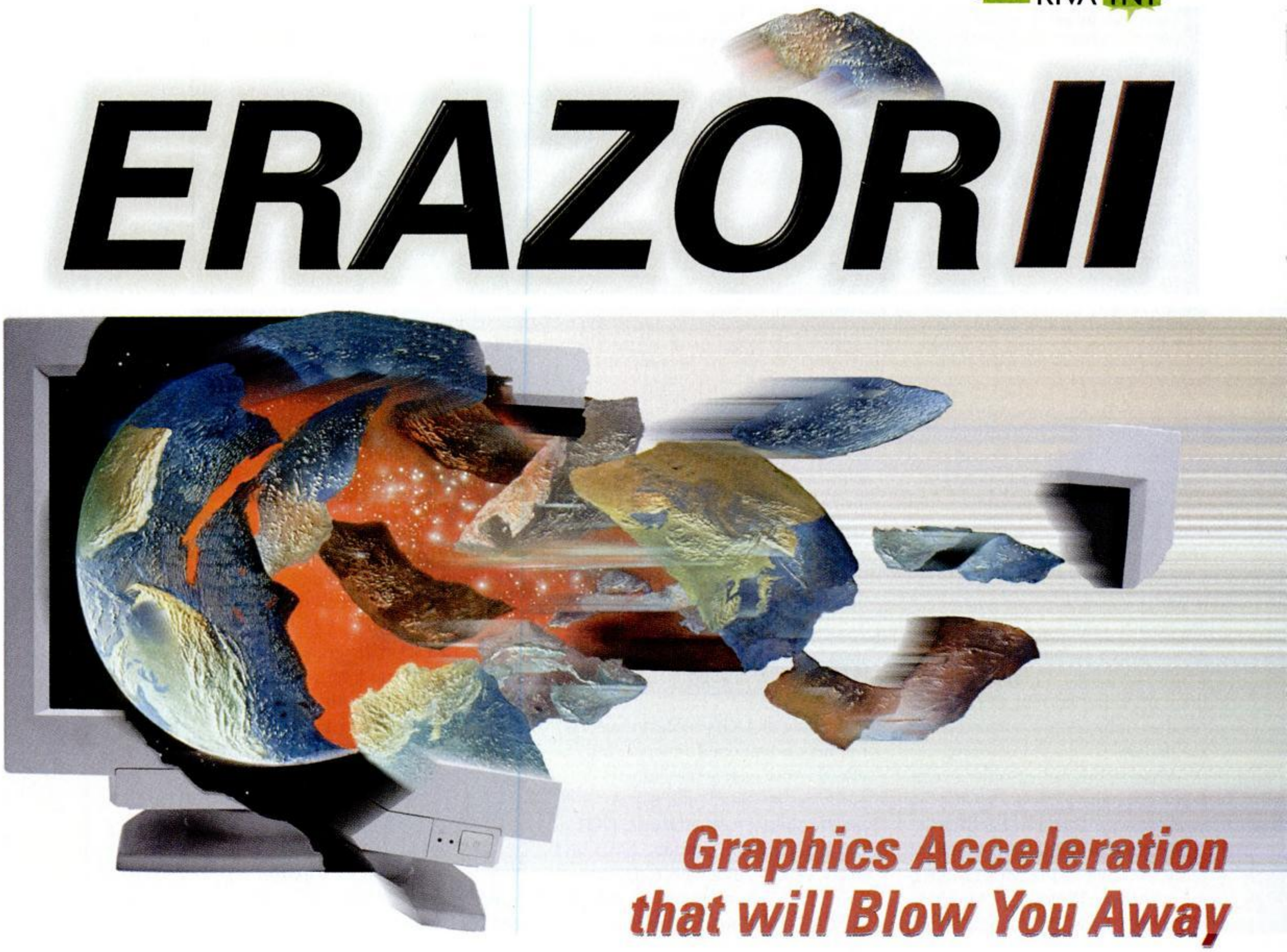

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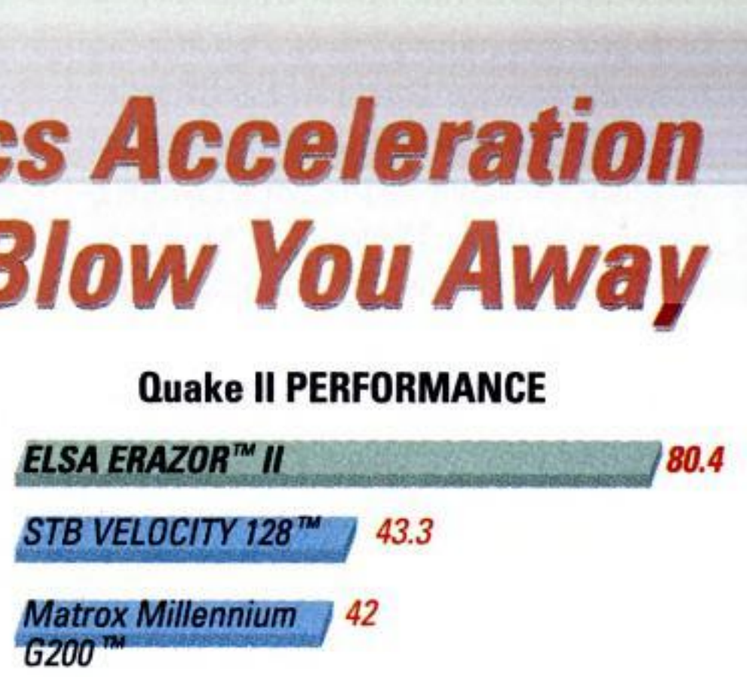

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All tests in FPS. All cards run with vertical sync off. All cards tested on an Intel dual Xeon with 256MB RAM running Windows 95 with DirectX6.

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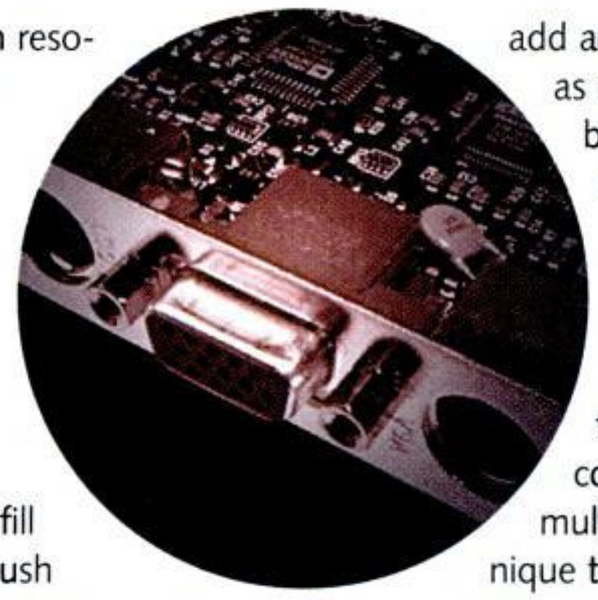
Videocards

Last year was hot as Texas asphalt for 3D accelerators. While some manufacturers survived and prospered, others were burned to a crisp. (When's the last time you heard positive buzz about Oak Technologies, Chromatic Research, Tseng Labs, or TriTech?) This year promises to be even hotter, with accelerators one-upping each other to win mindshare among the Pure PC Power set. Here's the 411 on what performance levels and features to expect in 1999, and which chipsets will be vying for the 3D crown.

Performance Plateaus

Last year, a dual-Voodoo^2 ScanLine Interleave (SLI) configuration represented the pinnacle of 3D power. In 1999, however, any accelerator that wants to be taken seriously will have to offer dual-Voodoo^2 SLI-level performance as a bare *minimum*—across both Direct3D *and* OpenGL gaming.

When discussing an accelerator's performance, the most germane spec is fill rate—the number of pixels that a card pumps on-screen during a fixed span of time. Measured in millions of pixels per second (Mpixels/sec), the greater the fill rate, the faster the accelerator can rasterize at a given resolution and level of texturing complexity. High screen resolutions literally put more pixels on screen, which demands that the accelerator works harder to maintain smooth framerates. Game developers are demanding higher fill rates so they can push resolutions to 1024x768, create larger polygon-count models, and add more special effects without slowing framerates to a crawl.



15 pins of texture-loving goodness.

Last year's fill rate winner was dual-Voodoo^2 SLI, which clocked in at roughly 200Mpixels/sec. Its closest competitor was nVidia's TNT chipset, which pumped rates around 140, depending on which 3D features were turned on. This year, expect 400 to 500Mpixels/sec from top-of-the-line accelerators.

When bandying about fill-rate specs, you also must consider how pixels are processed; adding effects such as anti-aliasing and bilinear, trilinear, and anisotropic filtering works the accelerator harder. Most accelerators can now do bilinear filtering without flinching, while others are processing trilinear filtering without a big performance hit. But when you add advanced features such as multitexturing and bump-mapping, you need to start worrying about speed.

In 1999, game developers will leverage the best accelerators' high fill rates by coding more games for multitexturing, a technique that layers different textures on top of one another for spectacular visual effects (see diagram, page 62). For smooth framerates, it's imperative that these multiple textures be rendered in a single processing cycle; if the texture rendering requires more than one pass, the game will slow to a glitchy mess. To execute multitexturing in a single pass, an accelerator needs multiple processing pipelines—one pipeline to digest each texture layer.

Bump-mapping will be one of the most spectacular multitexturing effects that we'll see in 1999—and it will definitely require multiple pipelines.

Bump-mapping will be one of the most spectacular multitexturing effects that we'll see in 1999—and it will definitely require multiple pipelines. This technique simulates elaborate surface textures on objects that would otherwise be smooth and flat. Essentially, a displacement map texture sits on top of a polygon's base texture. The displacement map is riddled with grid points that describe texture grain—everything from cracks on clay tablets to dimples on a golf ball. When environmental light sources hit the grid points, reflection and shadowing effects appear according to the map pattern.

Currently, only the Voodoo^2, TNT, and the Rage 128 chipsets employ dual-pipeline architectures for effective multitexturing. In 1999, we might see some pipelining surprises.

Beside multitexturing, accelerators will need the raw power to handle 1024x768 and higher resolutions, and 24-/32-bit color. With more colors, you'll see less color banding and richer, more realistic textures. And a higher color-depth z-buffer ensures you won't get any of the

3Dfx says a single Voodoo^3 chip will offer twice the performance of dual-Voodoo^2 SLI.

62 ▶

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pesky poke-throughs that occur when polygons fail to render.

Also expect this year's crop of texel tusslers to handle larger texture maps. Voodoo^2's biggest flaw is its inability to present textures larger than 256x256 (it downsamples everything larger to this resolution ceiling). This year, expect 512x512 textures to be the standard. The higher the texture resolution, the sharper everything looks on screen. Also, all worthy chipsets will support some type of texture compression to fit larger textures in smaller memory spaces. Some manufacturers will support the compression offered by DirectX 6 (Microsoft licensed these compression algorithms from S3), but ATI will be going with its own proprietary technology.

After taking a good look-see at the competition's roadmap, the boys decided to shoot for the stars with Glaze3D

Speaking of textures: In the latter half of 1999, we'll also see core-logic chipsets that extend Intel's Accelerated Graphics Port (AGP) from 2x to 4x. AGP 4x will facilitate four data transfers per 66MHz clock cycle for 266MHz bus throughput. While the AGP 4x data path still isn't as fast as the memory soldered onto the videocards themselves, it's getting there, and you can count on big-name developers to start using the AGP bus to pump richer textures that spill over with splashier colors.

Despite all the hoopla over AGP, don't expect local video memory to disappear anytime soon. Expect most 3D accelerators to support up to 32MB of local memory, and SDRAM to fully replace EDO DRAM as the entry-level memory of choice. Faster SGRAM will continue to flourish, but expect some architectures to support esoteric flavors such as Double Data Rate DRAM, Rambus, and others.

We should also note that 3D acceleration needs help on the front of the processing pipeline. To this end, Fujitsu will be pimping its Pinolite geometry engine to anyone interested (Rendition has toyed with the idea of integrating Pinolite in its stop-gap Conspiracy architecture). And, of course, CPU technologies such as AMD's 3DNow! and Intel's Katmai will offer profound transformation and lighting benefits in 1999.

The Players

The following developers will throw their hats into the 3D acceleration ring in 1999. Don't count anybody out. 1998 taught us that even perennial losers can turn around and release good technology.

► **3Dfx** Due out in Q2 1999, 3Dfx's next-gen Voodoo^3 is gearing to offer more than twice the performance a dual Voodoo^2 SLI configuration—high aspirations for a single .25-micron, integrated 2D/3D chip. 3Dfx says the motherboard version, the 125MHz Voodoo^3 2000, will offer a 250Mpixels/sec fill rate, while the power gamer's 183MHz Voodoo^3 3000 will clock in at better than 366Mpixels/sec. Internally rendering at 32-bits but dithering down the output to 16-bits, both chips are AGP 2x; 4x versions will be ready when Intel ups the AGP spec.

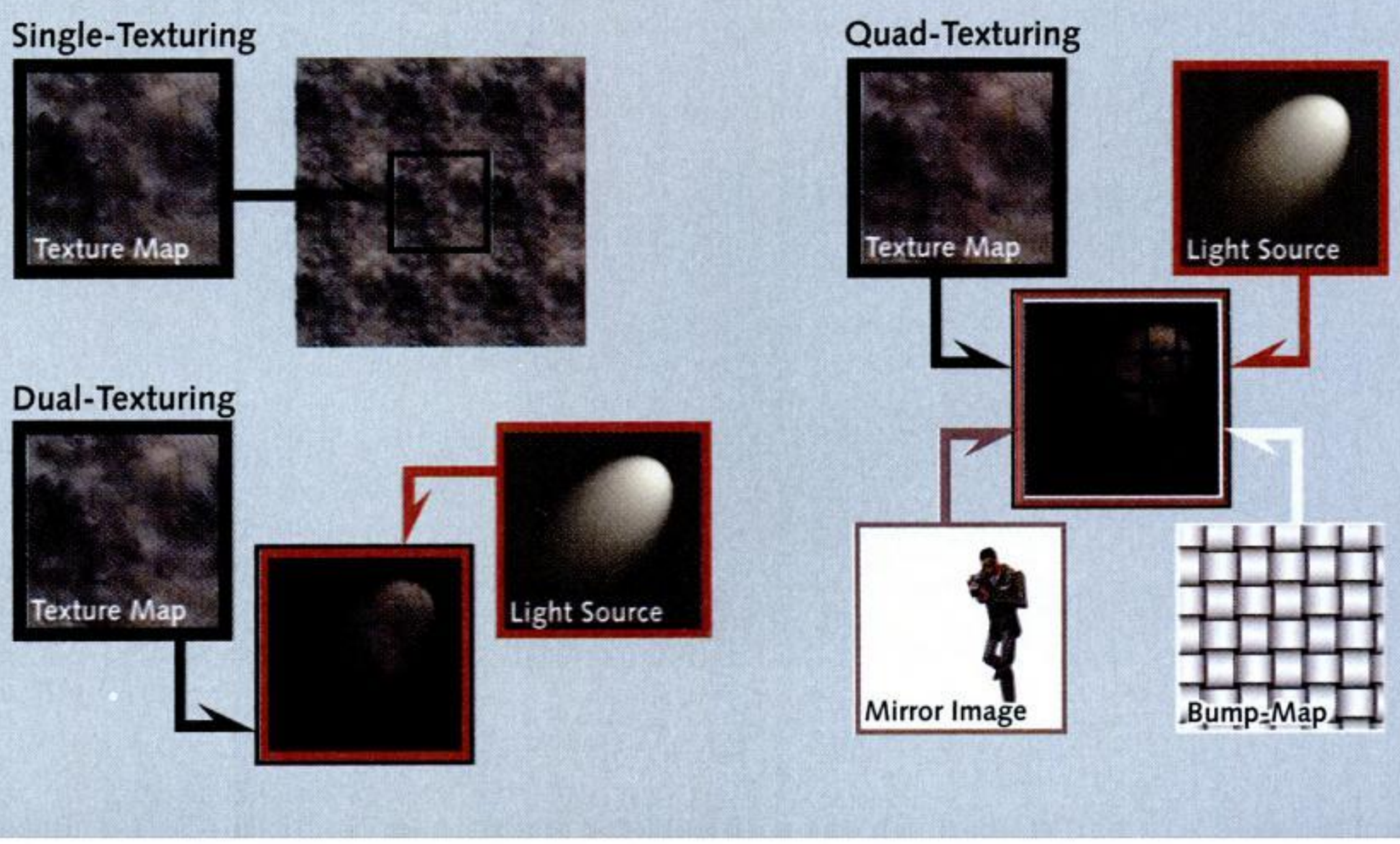
3Dfx is avoiding AGP direct memory execution for its 2x part. Memory options (from 4 to 16MB) include SGRAM and SDRAM—no surprise there—but we were surprised to learn that the Voodoo^3's RAMDAC hits 350MHz, the world's fastest DAC speed to support resolutions up to 2048x1536 at a 75Hz refresh rate. The chip will also include hardware DVD support, but sadly its 3D architecture is limited to two pipes—no quad-texturing in a single pass for you! But, expect 60fps at 1280x1024.

► **3Dlabs** The Permedia 3—another 2D/3D AGP 2x chip that sounds great on paper—is aiming for top-flight consumer and entry-level pro rendering performance. Its feature set is in line with all the other parts everyone's raving about—32-bit rendering accuracy (both z-buffer and output), per-pixel trilinear mip-mapping, single-pass multitexturing, bump-mapping, and more. Cards based on Permedia 3 technology should be making the rounds around Q1 of

64 ▶

3D Multitexturing

Any kind of multitexturing must be executed in a single processing cycle, lest your game slow to an unplayable crawl. In our dual-texturing example, an animated light map has been superimposed on a base texture. In our quad-texturing example, four processing pipelines would be necessary to pull off the four texture superimpositions without a hiccup. Only Bitboys Oy's Glaze 3D is shooting for this level of performance.



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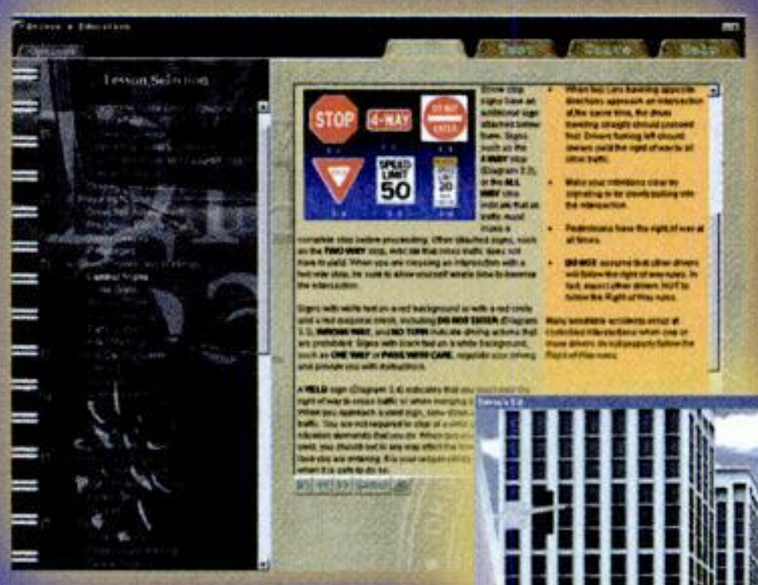

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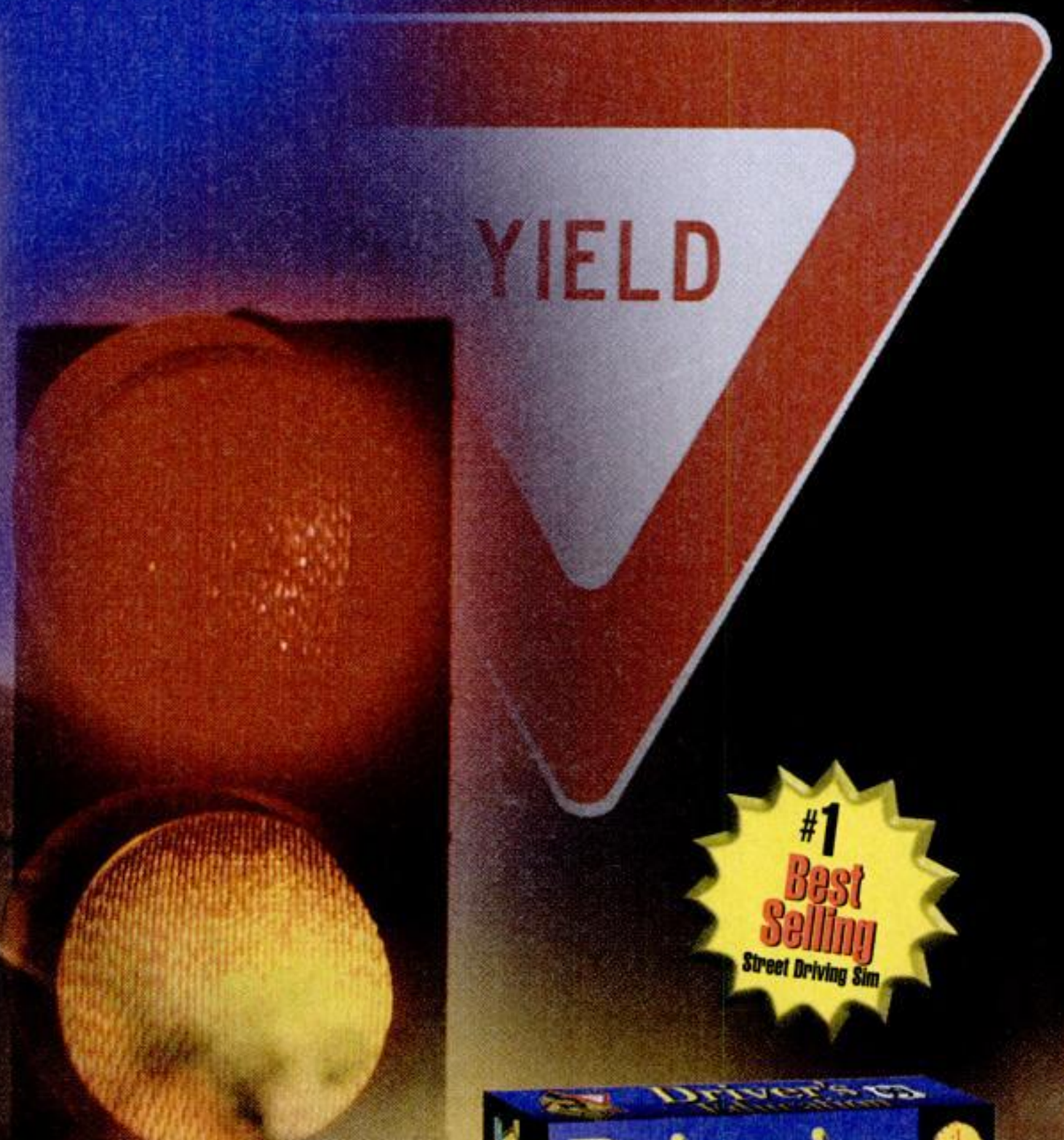

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1999. But if the chip doesn't meet or exceed current top-of-the-line standards in visual quality and performance, the Permedia 3 may meet its predecessor's fate and wind up as a low-priced professional OpenGL card.

The Vanta Initiative is nVidia's attempt to penetrate the vast corporate market that normally eschews high-per formance 3D chips.

► **Alliance Semiconductor** Alliance was responsible for the 2D side in 3Dfx's integrated 2D/3D Voodoo Rush architecture. Now this company is pushing its own Paladin 3D accelerator technology, which will come in both AGP 1x and 2x flavors and handle up to 16MB of EDO, SDRAM, or SGRAM. Sadly, the Paladin's dearth of next-gen specs—such as single-cycle multitexturing and bump-mapping—is dubious considering all the high-powered chipsets on the 1999 docket. Regardless, expect Paladin 3D-based cards to start filtering in as you read this.

► **ATI** The 2D/3D Rage 128 should currently be on store shelves. Shooting for nVidia TNT-level performance, the Rage 128 mirrors many of the TNT's features, such as a dual graphics processing pipeline for dual-texturing in a single pass. But support for up to 32MB of SDRAM is one thing that'll make folks perk up and take notice. Let's just hope OpenGL integration isn't an afterthought like it was in the Rage Pro.

► **Bitboys Oy** 3D accelerator mavens might remember the stillborn Pyramid-3D chip, a bump-mapping yet underpowered accelerator from TriTech. Bitboys Oy was responsible for the Pyramid3D's core technology, and after taking a good look-see at the competition's roadmap, the boys decided to shoot for the stars with Glaze3D. We don't know much about Bitboys' strategy to take on industry anchors such as 3Dfx, and ATI, but on paper the Glaze3D looks mighty impressive: 2D/3D single-chip solution operating at 200MHz; bilinear/trilinear mip-mapping, with up to four independent trilinear-filtered textures processed in a single pass (Voodoo^2 and TNT do just two textures); 4096x4096 maximum texture size; support for 16MB to 64MB of local memory (Rambus, DirectRDRAM, or SDRAM) running at up to 400MHz; 32-bit accurate rendering pipeline and z-buffer; programmable triangle setup engine; 16K texture cache, 8K stencil buffer; anti-aliasing; and support for an SLI configuration (via two chips) on a single board.

Bitboys Oy has yet to show us silicon, so it remains to be seen whether it really has what it takes to kick down the big boys.

► **Intel** The processor powerhouse has been tight-lipped regarding its successor to the i740, the company's first entry in the 3D chipset arena. We've heard through the grapevine, however, that Real3D, which co-engineered i740, may not be working with Intel on its next-gen chip. Real3D may instead produce its own consumer-level chip for 1999. Where does that leave Intel? It still has the Whitney core-logic AGPset coming, which integrates i740 into motherboard-bound silicon.

► **Matrox** After wowing the world with its MGA-G200 (one of the best comeback products of 1998), Matrox isn't planning to sit by and watch its metal rust. Expect a major new architecture to be announced sometime in early 1999. We do indeed know what Matrox is up to, but if we told you now, they'd send their legal ninja over to slice us into petite prime rib cuts.

► **NEC/PowerVR** If all goes well, PowerVR Second Generation should be out by the time you read this. But keep in mind that faithful PowerVR folk have been eagerly awaiting this second coming since it was announced (and demo'd) at Comdex 1997.

The tiled-based, z-bufferless PVRSG looks intriguing: up to 32MB of local memory, full AGP 2x support, and better integration of 3D functionality. But can PowerVR regain what little momentum it had before focusing all of its development efforts on the Sega DreamCast console? The 3D accelerator battle royale doesn't pamper weaklings, and while PVRSG will eventually trickle onto store shelves, you should expect other major players to trumpet next-generation hardware with even fancier specs.

PVRSG will be available in integrated 2D/3D solutions, as well as a freestanding 3D-only add-in card. Pricing will begin at under $100.

► **nVidia** With the TwiN Texel chipset firmly established as the new 2D/3D ruler, nVidia has been mum regarding its next-generation part—but they have told us they will introduce a significant new polygon-cruncher sometime in 1999.

Meanwhile, TNT is trying to go where no nVidia part has gone before—the business market. The Vanta Initiative is nVidia's attempt to penetrate the vast corporate market that normally eschews high-performance 3D

66 ►

The Future Sound of Silicon

1999 will be the year Creative Labs and Aureal build on their current lines of breakthrough sound technology. Last year, Aureal introduced its A3D 2.0 spec, which uses wavetracing technology to create ambient 3D sound (Diamond's Monster Sound MX-300 was a notable A3D 2.0 benefactor). Creative Labs, meanwhile, splashed down with the EAX 1.0 technology found in the Sound Blaster Live! card (EAX uses reverb, echo, and other effects to simulate realistic soundscapes). Expect both sound technologies to mature in the coming months. EAX 2.0, for example, will include obstruction effects and support for HRTF routines on multiple speakers.

In fact, both Creative and Diamond/Aureal will fully implement speaker madness in the next few months. Creative will offer an eight-speaker set-up for the Live!, as well as optical digital connectivity for people with DAT and mini-disc players. Creative's audio muscle—with a little elbow grease from Microsoft—will also power a multi-track-recording WAV format. Also, by the end of 1999 expect to see game titles that use 3D positional sound coupled with static AC-3 or Dolby Digital sound. Finally, while Creative hasn't leaked news of any specific new cards, the company's marketing history tells us to look for a whole new slate of products that use the Live's core technology. Even an external box that connects to your PC via IEEE 1394—isolating the Live!'s DSP from the motherboard's electrical interference greatly reduces signal noise. *—Gordon Ung*

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chips. Based on current TwiN Texel technology, the .25-micron-fab Vanta differs from its brother in that it uses a narrower 64-bit architecture, supports up to 32MB of local memory and AGP 4x.

Vanta, a motherboard-only video chipset, includes support for flat-panel displays. Vanta-enabled motherboards should be available sometime in Q2 of 1999. In related news, the current TNT architecture will soon get a shot in the arm thanks to a revision code-named TNT2. Reducing the fab to .25-micron will allow nVidia to boost clock speed. Also, local memory support will jump to 32MB. During this "mid-cycle refresh," nVidia expects to optimize TNT's processing pipeline even further, and put performance somewhere in the Voodoo^3 space. Expect these new revs to arrive around Q2 1999.

► **Rendition** Remember hearing rumors about RRedline, aka V3x00, Rendition's next-gen 2D/3D architecture? It may never see the light of day, thanks to a Rendition/Micron leapfrogging strategy. The new plan calls for the V4400E, a video chip that'll combine a souped-up Vérité core with embedded memory. Solid specifications and performance goals have yet to be announced. According to sources at Rendition, the first run of RRedline is back from fab, but Rendition plans on seeding OEMs and game developers to see if it's viable. But if an attempted rollout of RRedline gets in the way of the V4400E's development and introduction, Rendition will not bring RRedline to market. Where does that leave the Vérité faithful? About six months without a new technology, because the V4400E is not slated until mid-1999.

► **Stellar Semiconductors** PixelSquirt may sound nasty, but Stellar Semiconductors hopes its next-gen 2D/3D hardware will be the next videocard to grace your AGP slot. PixelSquirt is the underlying architecture from which two distinct cores will be forged: PXm, a DirectX 5 engine for entry-level solutions, and the TXm, a DX6 core aimed at hardcore gamers. Using a z-bufferless rendering style, PixelSquirt has all the specs to make it a winner. Expect 32-bit color rendering, full-scene anti-aliasing, single-cycle dual-texturing, and more.

Q1 1999 is the target date for OEM sampling, with retail boards appearing shortly thereafter.

► **Trident Microsystems** After its abysmal showing last year, Trident will try again with its Blade 3D media accelerator. Targeted at low-end desktops, this .25-micron 2D/3D chip claims a maximum fill rate of 110Mpixels/sec, support for OpenGL, Direct3D DX6.0, anisotropic and trilinear filtering, and texture compression. The Blade 3D will also support THAMA DVD Playback (Trident Hardware Assisted MPEG2/ AC3), so expect full-screen DVD to be in full effect as well. Blade 3D will be available in Q1 1999.

—Andrew Sanchez

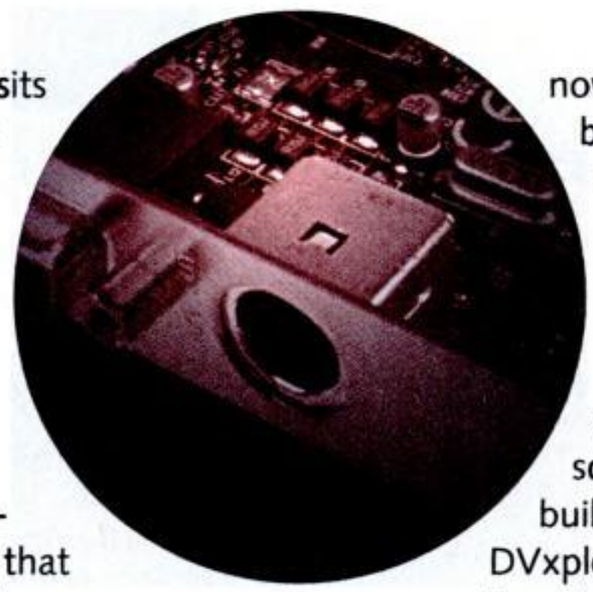
Digital Video

Imagine the day when we'll no longer use videotape to record home movies and television shows. Instead, all recording, editing, and playback will be handled through the PC. This might sound like science fiction, but the technology is actually coming to stores later this year, and MPEG-2 is the codec that's bringing it all together.

For desktop DV freaks, the great thing about MPEG-2 is its incredibly efficient compression ratio.

MPEG-2 is currently used in DSS transmissions, the video-on-demand that's available through hotel room TVs, and the DVD movies you rent from your local video store. For desktop DV freaks, the great thing about MPEG-2 is its incredibly efficient compression ratio, which allows hardware to stream high-quality video at low data rates.

In DVD movies, high-quality MPEG-2 video peaks at around 1.2MB/sec. VHS-quality MPEG-2 video, meanwhile, only requires 0.6MB/sec throughput, which is easily handled by the EIDE hard drive interface that sits in all computers. At 0.6MB/sec, you could stream an entire feature-length Hollywood movie to an 8GB hard drive. To put all these low data transfer rates in perspective, remember that IEEE 1394 is spec'd to stream at a steady 3.6MB/sec.



Your next "Dawson's Creek" recorder?

By Q3 this year, ATI, Matrox, and Creative Labs should be shipping $300 MPEG-2 encoder cards using C-Cube's DVxplore chip. These cards promise to let you record your favorite television programs to hard disk at a quality that's as clean and clear as a DVD title. Most of the new MPEG-2 encoder boards will also include realtime software editors. When finished, you can either output your finished video to tape or archive everything to one of the DVD recordable solutions described on page 59. Right now, it seems most board manufacturers are leaning toward bundling Ulead's *VideoStudio*, which should be a $99 stand-alone product in Q3. This software uses hooks built into C-Cube's DVxplore architecture that allow it to support I/P/B frame editing, as well as realtime transitions.

Unlike *Media Studio Pro*, which is Ulead's pro-level editor, *VideoStudio* is geared toward consumers who don't want to spend hours reading a manual. From *VideoStudio*'s main interface you can capture audio and video, edit title text, choose from more than 100 transitions (such as dissolves, cross-fades, and wipes), record voice-over narration, and e-mail video to others. Best of all, you can learn the application in about 45 minutes.

"Motion JPEG is dead," says Brent

68 ►

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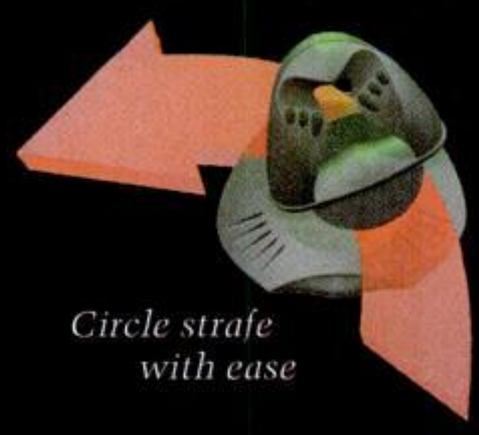

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McKendry, Ulead's product marketing manager. "We're in a new paradigm with better-quality video, lower bit rates, and realtime effects that can be had for thousands of dollars less than current M-JPEG solutions."

"We're in a new paradigm with better-quality video, lower bit rates, and realtime effects."

Another tool to watch is VITEC's MPEG Toolbox-2, a $240 encoder/editor that transcodes previously captured AVIs into an editable MPEG-2 stream. This software, which should be selling by the time you read this, works with any Motion-JPEG capture board currently available. The only problem with this solution is that the editor only edits I and P frames, which offer one-quarter to one-eighth second accuracy. This isn't sufficient for professional editors who need frame-accurate cuts, but it is acceptable for casual users who want to piece together home videos. VITEC currently sells a professional MPEG-2 editor called Video Clip MPEG-2. This is a $1,250 tool that lets you edit I/P/B frames, and gives you the ability to separate and bring together audio clips.

VideoStudio offers an interface easy enough for the dolts in this screenshot.

All of the aforementioned products will work flawlessly with currently shipping Ultra DMA hard drives (desktop DV previously required dedicated SCSI drives). By the end of the year, if you have a video camera, PC, and one of these new MPEG-2 solutions, you'll be able to create high-quality video that rivals what professional production houses were doing just a year ago. Just remember this as you stare at the blinking 12:00 on your VCR. You'll be able to toss that old technology out the window and confidently join the digital-video revolution. ✹

—Rick Popko

The Fastest Drive on Earth

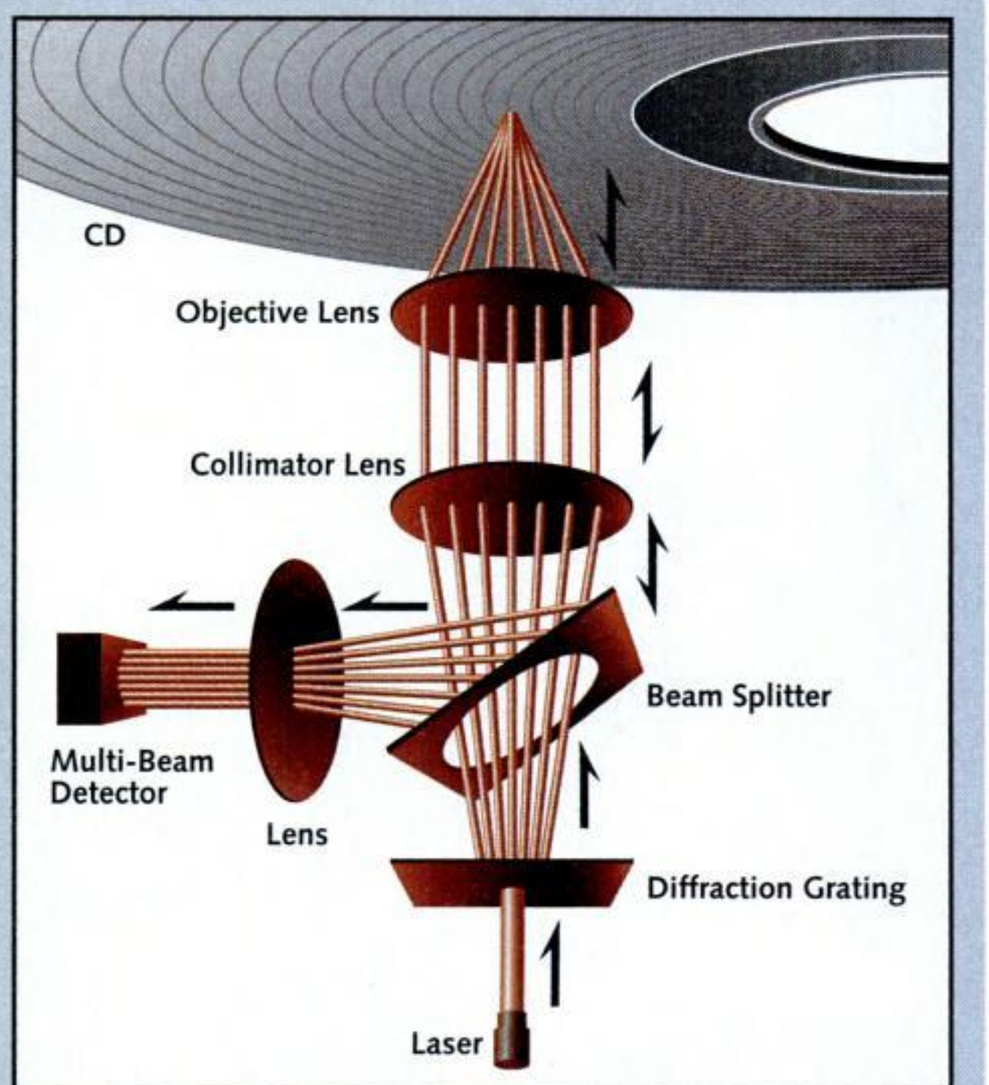
Although CD-ROM drives will continue to play a role in content delivery, they're quickly fading from relevance. 1999 will be the year of the DVD-ROM. But who will have this year's killer drive?

All indications suggest this honor will fall to Kenwood's first DVD-ROM drive, which will use Zen's vaunted TrueX technology. Zen says it has conservatively spec'd its DVD-ROM technology to consistently rip at a 10x DVD-ROM performance rating (peaking at 20x) and hit 60x to 80x on the CD-ROM performance chart. Zen also says access times will fly, quoting numbers around 80ms. The Zen spec allows for DVD-RAM compatibility, but independent manufacturers such as Kenwood will ultimately decide which features make it in.

Zen's TrueX technology splits a drive's laser into multiple beams that read different data tracks simultaneously, increasing overall read bandwidth. TrueX CD-ROM technology uses seven beams—six for data reads and one for error-checking. In DVD-ROM drives, Zen will increase the number of beams for even more simultaneous reads. By increasing overall performance with this multireading method, Zen can also lower a drive's rotation speed, which allows for less vibration and more consistent performance, assuring the drive never falls below its spec'd performance rating.

TrueX DVD-ROM drives will support SCSI, Ultra DMA IDE, and 1394 for ultimate plug-n-play goodness. Zen knows its stuff is dope and plans on getting drives into your hot hands by the first part of 1999.

—Sean Cleveland



If you follow along with the arrows on the diagram, the following explanation of TrueX technology actually makes sense: A single laser diode is sent through a diffraction grating that splits it into seven different, evenly spaced beams. These beams then pass through a beam-splitting mirror, then a collimator lens that straightens the beams before passing through an objective lens that focuses the beams onto the media surfacer. The reflected beams return via the same path and are intercepted by the beam-splitter array, which redirects them to a beam detector array that reads the data.

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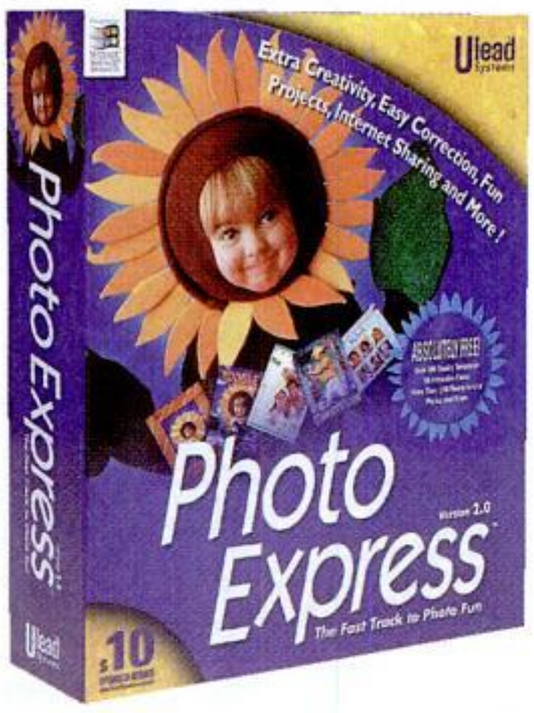

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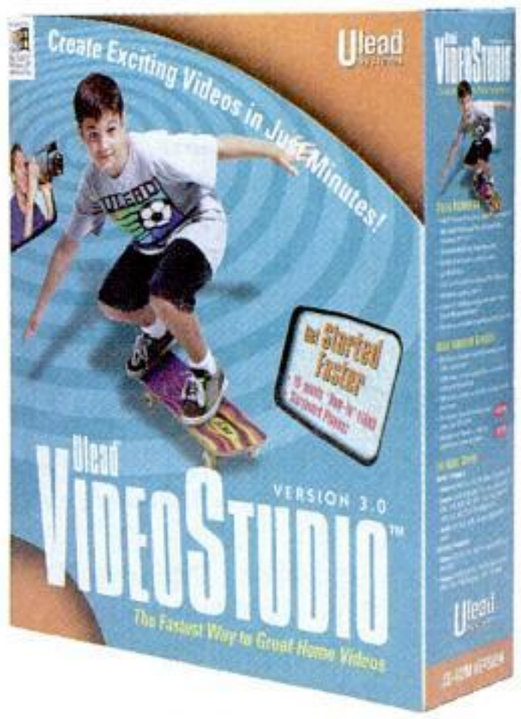

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It's a USB Bonanza

1998's Vapor Technology is Prime-Time in '99

USB. Never before have three little letters held so much promise. With a 12Mbps digital bandwidth, seamless hot-swapping, and the ability to daisy-chain up to 127 devices simultaneously, USB was hyped as the Next Big Thing for PC connectivity. Goodbye serial, parallel, and game-ports—just plug in your device and you're good to go. The revolutionary new peripheral interface would end our installation woes and save us valuable IRQs.

There was only one little problem: In 1998, everyone had the ports, but there were almost no USB devices to buy. But 1999's a different story. Here's a blow-out collection of more than 75 USB peripherals to prove the technology is real and ready to rock your lonely little interface.

—Bryan Del Rizzo

1 Thrustmaster Top Gun joystick
www.thrustmaster.com; $40

2 UMAX Astra 1220U scanner
www.umax.com; $149

3 Logitech QuickCam Home internet video camera www.logitech.com; $219

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5 CTX EX 1200 21-inch monitor with USB hub www.ctxintl.com; $1,185

6 Aladdin Knowledge Systems HASP software protection system
www.aks.com; $14

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www.belkin.com; $70

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9 Entrega 7-port hub
www.entrega.com; $120

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11 Ariston Technologies Ares Ultimate Warrior joystick
www.ariston.com; $45

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www.opti-ups.com; $225

13 Belkin BusPort USB upgrade kit
www.belkin.com; $40

14 Kodak DVC 323 digital camera
www.kodak.com; $169

15 Creative Labs WebCam II
www.soundblaster.com; $99

16 Logitech QuickCam VC
www.logitech.com; $120

17 Philips DSS 370 digital speaker system www.philips.com; $160

18 Hewlett-Packard ScanJet 4100C scanner www.scanjet.hp.com; $200

19 Interex dual-port adapter cable
www.interex.com; $13

20 Entrega USB 2-port upgrade kit
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22 Computer Access Tech. Corp. NetMate Link USB to Ethernet Adapter www.catc.com; $99

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www.ariston.com; $105

24 Intel Create & Share Camera Pack www.intel.com; $199

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26 Altec Lansing ADA 305 digital speaker system with Dolby Pro Logic www.altecmm.com; $200

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35 Compaq TFT500 15-inch flat-panel monitor with USB hub
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41 Microsoft IntelliMouse
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33 WingMan Force joystick Force-feedback is all the rage in arcades, but it's been a snore on the PC. Logitech hopes to wake up the world with WingMan Force, a USB joystick that adopts unique cable drive technology instead of the more traditional gear-and-motor combo. The stick incorporates nine programmable fire buttons, a contoured handle, and an eight-way hatswitch to provide a jolting good time.
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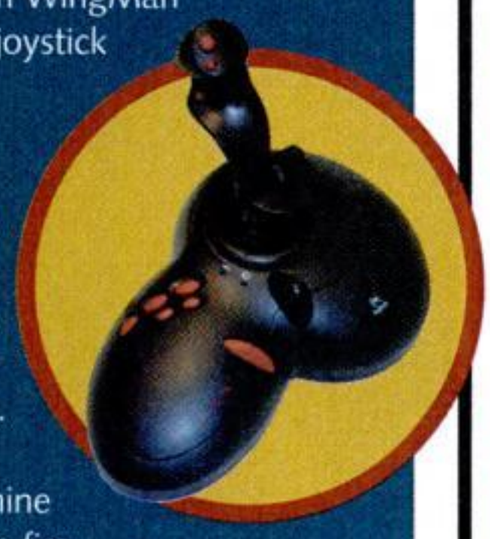

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www.quickshot.com; $43

58 ADS PC Card USB notebook adapter www.adstech.com; $80

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www.cherrycorp.com; $100

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www.gravis.com; $30

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69 Interex 2-meter device cable
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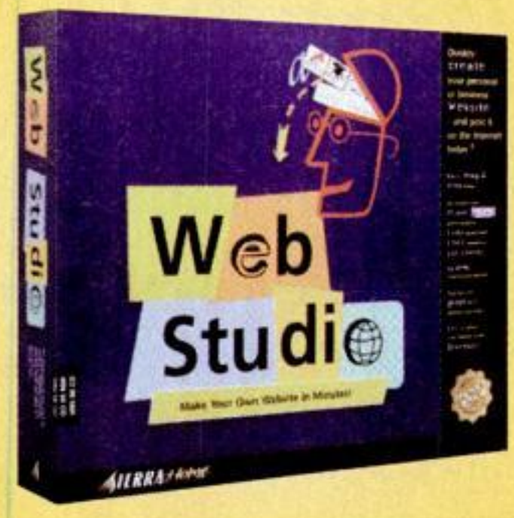

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SLI Odd Couples

I have a 12MB Diamond Voodoo^2. Can I add another manufacturer's Voodoo^2 card to go SLI, or do I have to get another Diamond card?

—Mark Simony

Yes and no. It's been reported that you can accomplish this by using 3Dfx's older reference drivers. But I tested this in our Labs and couldn't get it to work, so I consulted Tony Tamasi, 3Dfx's Senior Product Manager. He replies:

"Our reference drivers do *not* allow different Voodoo^2 boards to be used in SLI. We don't want a situation where you can't get support from either manufacturer because the finger of responsibility doesn't rest squarely on either one.

Voodoo^2 cards like to mate within their own species.

"Some Voodoo^2 boards differ from the reference design (or other Voodoo^2 board designs) and can exhibit different electrical or timing characteristics. The SLI interconnect is sensitive enough that 3Dfx can't guarantee different Voodoo^2 designs working together in SLI.

"Board manufacturers such as Metabyte are free to create drivers that allow their boards to work in SLI with other manufacturer's cards, and in doing so they assume the support responsibility regardless of who manufactured the other Voodoo^2 board."

DirectX Be Gone

After getting DirectX 6.0 directly from Microsoft's web site, I installed it, and it refuses to get along with many of my 3D games, such as *Final Fantasy VII* and *Redline Racer* (nasty display bugs). I want DirectX 5.0 back, but nothing I've tried works. There's no option for restoring DirectX 5.0 (it will restore the Audio and Video drivers to version 5, but Direct3D, DirectDraw, and DirectPlay remain at 6) and older versions of DirectX just keep the new drivers. I refuse to reformat my hard drive.

—Jon Taylor

DirectX isn't designed to be uninstalled. It's tightly integrated with many of Windows 95/98's core system services, so I don't recommend completely ripping it out of your system. You can disable 3D hardware support through Add/ Remove Programs, but you can't remove the core DirectX components without editing your Registry and deleting important Windows system files.

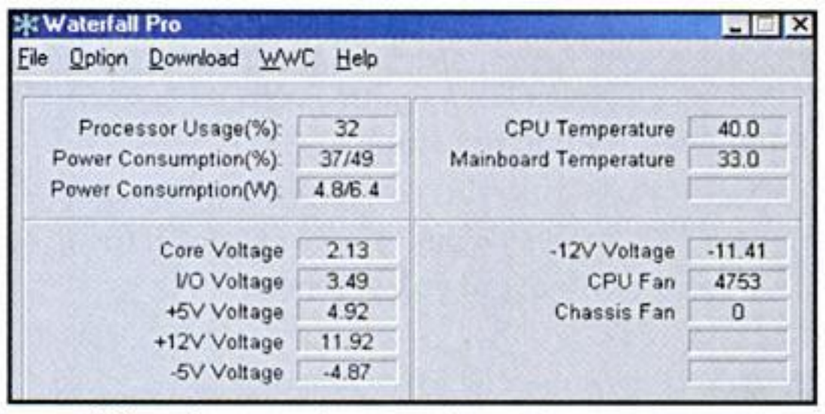
Even if you do manage to track down every VxD and DLL, Windows 98—and especially *Internet Explorer*—will freak out without the DirectX runtime installed (it ships with DirectX 5.2 firmly wrapped around its bloated little heart). Since this usually causes more damage than good, it's best to stick with the DirectX Diagnostic Tool (DXDIAG.EXE) to troubleshoot your problem.

Even if you track down every DirectX VxD and DLL, Windows 98—and especially Internet Explorer—will freak out without the DirectX runtime installed.

Chasing Waterfalls

My BIOS gives CPU temperature, but this isn't really helpful since the CPU isn't working very hard when I'm looking at the BIOS (right?). Is there a program that displays the temperature reading from BIOS in a Windows screen? I've tried the shareware programs *CPUmon* and *Alarm*, but they're written for different motherboards and don't seem to work properly with mine.

—Rick



Waterfall Pro keeps a close watch over how your CPU flows.

For reporting CPU temperatures in Windows , check out *Waterfall Pro* from Leading WinTech (**cpu.simplenet.com/ leading_wintech**). It not only uses the BIOS information to monitor your CPU usage and power consumption, but also claims to decrease your CPU's average operating temperature. You'll need to check whether your motherboard is supported, since there are specific modules for specific boards.

Monitor Rasa

I'm having problems running my Monster 3D II. I'm using the latest drivers from Diamond, and

Ask the Doctor

This month THE DOCTOR looks at:

- **Strange Voodoo^2 bedfellows**
- **Doing away with DirectX**
- **Monster refresh rates**
- **Deep Fifty-Sixing your modem**
- **Savage OpenGL**

and more.....

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Windows recognizes the card just fine, but when I run games using my Monster card, my screen goes blank (into low power mode, I think), and I have to reboot the system to get things running again.

—Vance Parkerson Jr.

The Monster 3D II's display applet takes care of many of the old Glide SST commands.

It sounds like you're trying to operate your monitor outside its recommended refresh-rate setting. You can check this by going into your Display Properties and selecting the Monster 3D II tab. Using the refresh rate slider on the left-hand side, set all your resolutions to 60Hz. Now, try firing up your game. If it still blacks out your screen, check your pass-through cable to make sure it's properly connected.

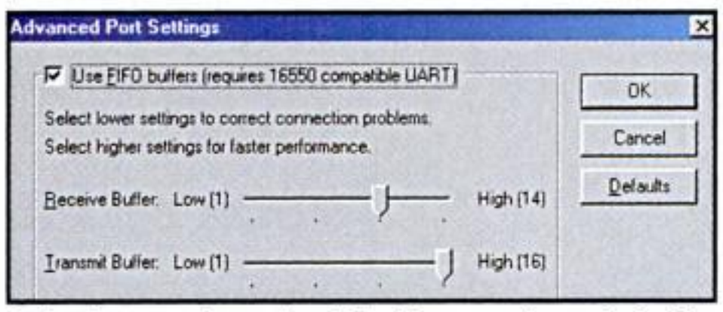
If you continue to have problems, look up what system resources your card is using in Windows Device Manager to make sure you're not getting any memory range conflicts. In a worst case scenario, you should try to uninstall and then re-install the drivers. If all this still doesn't solve your problem, you may just have a bum videocard.

Standard Subtraction

Ever since I installed the V.90 modem upgrade, my ping is anywhere from 600 to 700, making my online gaming life hell. I would like to know if there's a modem command string available to disable V.90? Any help would be appreciated so I can whoop ass in *Nascar 2.*

—Jonathan Hay

That depends on your modem. Check your manufacturer's web site for commands for its modems. For the very common 3Com/USR Sportster modems, you can enter ATS32=66 in your modem's Advanced Connection Settings to disable V.90. Setting register 32 to 34 disables X2 and setting it to 98 disables both.


Advanced Port Settings
Use FIFO buffers (requires 16550 compatible UART)
Select lower settings to correct connection problems.
Select higher settings for faster performance.
Receive Buffer: Low (1) High (14)
Transmit Buffer: Low (1) High (16)
OK
Cancel
Defaults

Adjusting modem signal buffers requires a lot of trial and error to be truly effective.

There are quite a few tricks you can try to get your ping times down, such as disabling V.90, X2, and K56flex in order to achieve more solid connections without any funny high-speed compression schemes. Playing with the buffer sliders reportedly helps, and of course making sure you have the latest .INF files can't hurt. For Windows 95 users, make sure you have the latest Winsock from Microsoft and the latest dialup network adapter (version 1.3) installed. A great resource for USR owners that has tips and links any online gamer can use is the *Quake II* X2 workshop at **www.navpoint.com/~zephed/qx2.html**.

Ignoble Savage

I purchased a Hercules Terminator Beast, based on the Savage3D chipset you previewed in the premiere issue. While it seems to be a good card, I'm having trouble running *Unreal* and *Quake II.* I have the latest OpenGL ICD in place, but should I use the default OpenGL renderer in *Quake II,* or is there a specific miniport OpenGL driver for the Savage3D to use with *Quake II*? I read on the Hercules page that a new version of *Unreal* with larger texture sizes has been released to take advantage of the Savage3D's texture compression, but I can't find it anywhere.

How did you post such fantastic benchmarks? What drivers were you using and where did you get them?

—Will Poirier

S3 has two types of OpenGL implementations currently running about. The one you're currently using is the OpenGL ICD that ships with the card. The other is an OpenGL-to-MTL mini-driver, which converts OpenGL calls to the Savage3D's native proprietary MeTaL API. Hercules was kind enough to send us a beta mini-driver for testing back for our November issue. You'll gain roughly 5fps to 10fps using the mini-driver, but you'll also gain visual defects such as a lack of alpha-blending, lighting problems, and more. Hopefully, these will be addressed with later revs of the mini-driver.

That special version of *Unreal* was made available as a public beta for a while. You can get it either on this month's Maximum CD (for those of you who get the Deluxe edition) or by surfing on by **http://s3.dimension3d.com** and jumping into their driver sections. ✹

Second Opinions ▶ READERS SHARE THEIR HOME REMEDIES

The Tell-Tale Pause

This is in response to a letter you had in the September 1998 issue titled "Annoying Direct 3D Pause." I had a similar problem with my Pentium Pro 200 with a Voodoo^2 accelerator. I tried everything to get rid of the hiccups (three stupid little pauses that happen for no apparent reason), even to the point that I killed all the resident programs that load when I boot. That didn't help. I finally wiped the hard drive, partitioned it, and ran a clean install of Windows. That fixed the problem—until my computer died.

I ended up sending it back to the manufacturer and had to go back to using my old Pentium 100 machine. Eventually I started to jones for some gaming and installed *Diablo* and my Voodoo^2 on the old machine, and it gave me those same stupid hiccups. I narrowed it down to either Microsoft's *Power Tools* (*Tweak UI* to be specific) or MS *Office.* Even when you kill all the resident apps, it still hiccups. But if I do a clean OS installation, I don't have a single problem as long as I leave MS *Office* and *Power Tools* off.

—Jason Marshall

Pass-Through Faux Pas

After reading your tip in the September issue about whether you could hook up a DVD player in the loop after a Voodoo^2 card and 2D card, I decided to buy the Creative Labs DVD player.

Initially I was going to buy a Canopus WitchDoctor board for the reverse pass-through TV-out, and then sometime in the future purchase a DVD kit. After reading your reply, I had the impression that the TV-out included with the DVD player would work for my Voodoo^2 if the DVD player were at the end of the chain. This isn't the case. The only thing that appears through the TV-out is the DVD movie playing, which is going to really suck for DVD games.

I thought I'd point this out to you, and I hope that for the future you verify your tips before giving them out. I'm sure that I'm not the only person to purchase a Creative Labs DVD player hoping that the TV-out would work for games, too.

—Cory La Belle ✹

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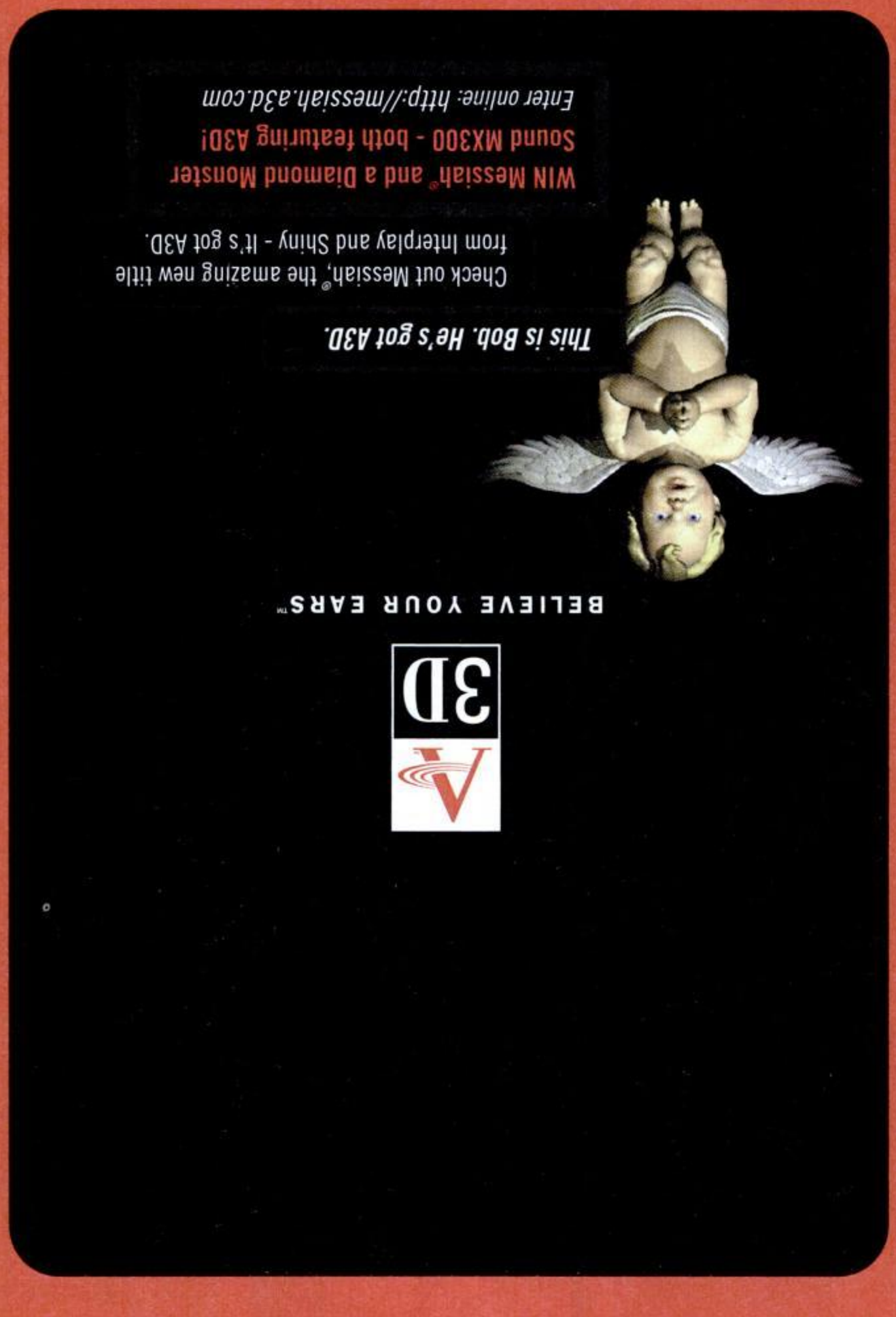
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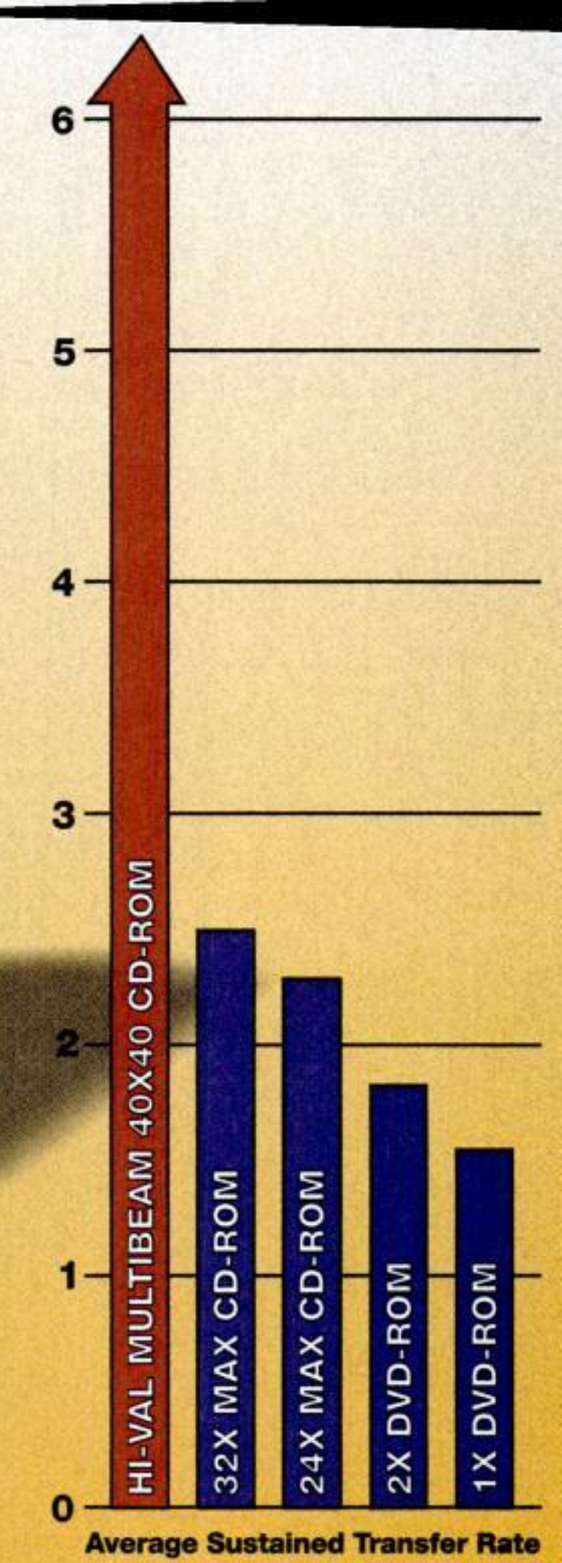

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In this issue

▶ HARDWARE

Diamond Monster Sound MX-300 81
Packard Bell Multimedia 830 82
NEC Versa LX 87
SGI 1600SW 92
JDR Microdevices FirezEdge 94
Sony 5x DVD-ROM Upgrade Kit 96
Hi-Val DVD-3 Kit 96
Creative Labs PC-DVD 5x Encore Kit 96

▶ SOFTWARE

Canvas 6 85

▶ GAMING

Trespasser 88
NFL Blitz 90
NFL GameDay 99 90
Madden 99 90
NCAA 99 90
NHL 99 100
Heart of Darkness 102

Testing Policy ▶

Our product evaluation process is built on down-and-dirty, hands-on testing. All hardware benchmarking is conducted in the Maximum PC lab by Maximum PC editors, and, whenever possible, we use real-world applications to gauge performance. Our final verdicts are based on benchmark results and a subjective appraisal of product features.

Real-World Benchmarking

Our benchmarking charts are simple: The farther right the bar reaches, the better the hardware performed. Here's the deal on specific benchmarks.

▶ **CPU/MOTHERBOARD** Based on Symantec's System Information benchmark, the bootMark tests low level motherboard components.

▶ **WINDOWS APPS** BAPCO's SYSmark98 uses task scripts in popular productivity and content creation apps to test system performance. The Official Score is based how fast the system can complete all tasks.

▶ **HARD DRIVE**
HD Tach measures multi-threaded hard drive performance. We publish the average 16k read score in megabytes per second.

Other Benchmarking

▶ **OPENGL** *Quake II* tests the 3D accelerator (along with its OpenGL drivers) and the CPU's floating-point. Using demo2.dm2, final score is in average frames per second at 800x600.

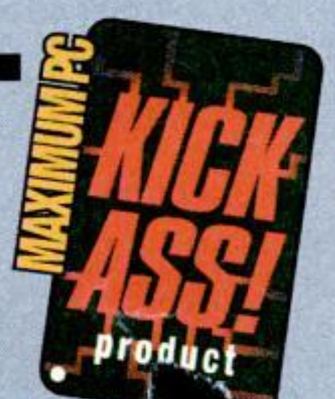
▶ **CD-ROM**
CD Tach measures CD-ROM read times and CPU utilization. We publish the drive's cumulative speed rating (e.g., 24x).

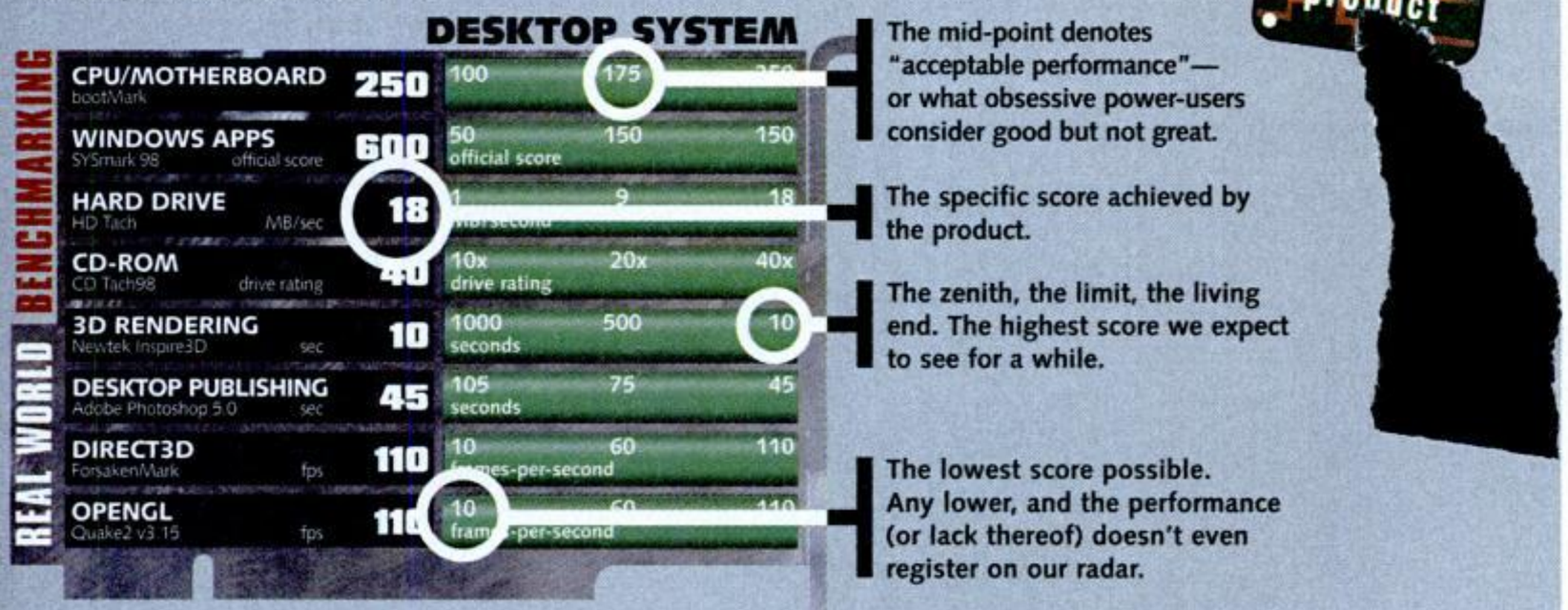
▶ **3D RENDERING**
We use Newtek *Inspire3D* to render a complex ray-traced scene. Final score is in total seconds from start to finish.

▶ **DESKTOP PUBLISHING** In a scripted Adobe *Photoshop 5.0* test, we record how long it takes to apply various filters to a control image. Final score is in total seconds from start to finish.

▶ **DIRECT3D** *Forsaken* is a space shooter that tests the system's Direct3D accelerator. Final score is in average frames per second at 800x600.

EDITOR'S CHOICE AWARD:
Only 9 and 10 verdicts are even eligible for the coveted Kick Ass award, the mark of PC excellence.





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Diamond Monster Sound MX-300

A second-gen A3D screamer

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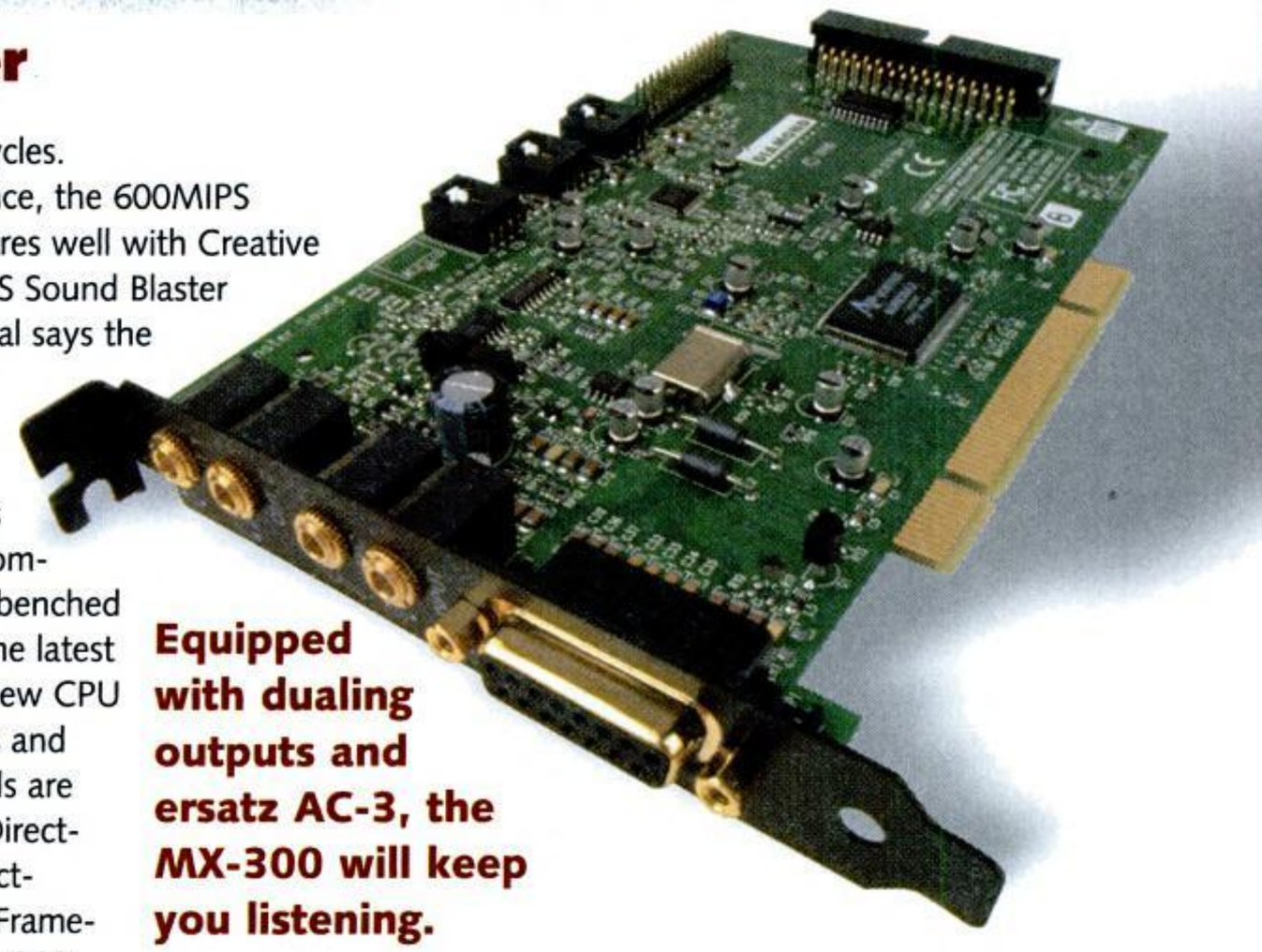
The offspring of Aureal and Diamond, the MX-300 is a major change for the Monster Sound family.

This time, Diamond dropped the aging Analog Devices DSP in favor of Aureal's new-fangled Vortex 2 chip. Soldered onto a medium-length PCI card, the MX-300's quad outputs will have your ears quivering.

The big feature of the card is the envelope-pushing A3D 2.0 and its wavetracing technology. Wavetracing attempts to model 3D positional sounds by creating a virtual world where reflections and occlusions are calculated according to the game's environment. In Valve's übergame, *Half-Life*, it accurately dampens sound when you tear around a corner. But sounds also unexpectedly pop up where they shouldn't, most likely due to the underripe release candidate of *Half-Life*. Wavetracing is better displayed with the A3D 2.0 demo, but even that shows the complex engine still has a few wrinkles.

More impressive in A3D 2.0 and *Half-Life* is the use of occlusions coupled with host-based reverberation. Noises sound as if they're passing through several walls, and the concrete stairwells offer reverb enough to satisfy, albeit at the cost of some CPU cycles.

In performance, the 600MIPS Vortex 2 compares well with Creative Labs' 1,000MIPS Sound Blaster Live! card. Aureal says the two companies use different scales, but in our benchmarks the two were comparable. We re-benched the Live! with the latest drivers on our new CPU utilization scales and found both cards are uneven under DirectSound and DirectSound3D tests. Framerates on the MX-300 were first rate and didn't suffer the problems previous Vortex 1–based cards had with *Unreal*.



Equipped with dualing outputs and ersatz AC-3, the MX-300 will keep you listening.

In specmanship, the MX-300 holds its own, offering 96 DMA channels, acceleration of 16 DirectSound3D sources, a 20-bit DAC, and 320 MIDI voices from a 64-voice hardware wavetable. Connectors on the card include analog inputs for CD, Aux, and Modem, plus a wavetable header.

A 10-band equalizer is nicely rolled into the tray with the same cool features as the MX-200. The stock general MIDI patch is fair, but pales compared to the Roland ROM that came with the MX-200. Both the Live! and MX-300 will put you on the map with their readiness for DirectMusic and possible return of MIDI to computer games. The MX-300 also offers near-full Sound Blaster legacy support without making you keep a redundant ISA soundcard. Aureal's TSR easily handled our DOS compatibility test. Joystick support is also better, but the MX-300 failed to recognize our Thrustmaster Rage.

The MX-300's money shot is the Dolby Digital virtualization down to quad speakers. With the included Zoran soft DVD, the MX-300 pumps out four channels of discrete sound, filling in the center channel of Dolby Digital with the two fronts. The effect shames Pro-Logic systems and can only be eclipsed by a full 5.1 system, which Diamond will add as a daughtercard option through the MX-300's "MX-Link" socket.

Although the solution is host-based, meaning it'll steal CPU cycles, we had no problems running both soft DVD and virtualization on a 400MHz Pentium II with a second-gen drive. The Zoran software gagged when we fed it streams from a third-gen DVD drive. Diamond said it has informed Zoran of the problem and should have a fix by the time you read this.

Diamond and Aureal have cooked up a winner. For the price of an MX-300, four speakers and a bare-bones DVD drive, you can have a full desktop experience plus A3D 2.0 support. While some kinks clearly need to be worked out, the MX-300 is worthy of your PCI slot.

—Gordon Ung

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RESOURCES
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REAL-WORLD BENCHMARKS

DIGITAL JOYSTICK COMPLIANCE	
Microsoft Force-Feedback joystick	Y
Thrustmaster Millennium Interceptor 3D	Y
Thrustmaster Rage3D	N
% CPU UTILIZATION VIA DIRECTSOUND	
Eight mixed signals*	15
Sixteen mixed signals*	20
Twenty-four mixed signals*	21
LEGACY REAL-MODE DOS SUPPORT	
Redneck Rampage (Pass/Fail)	Pass
Terranova (Pass/Fail)	Pass
GAME PERFORMANCE	
GLQuake II (640x480) (fps)	55.0
TurokMark (800x600) (fps)	47.9
Unreal (640x480) (fps)	46.3
WIN98 SOUND FEATURE SET	
DirectSound accelerator	Y
DirectSound3D accelerator	Y
A3D compliant	Y
Downloadable Sample (DLS) Compliant	Y
Adjustable sample RAM	Y

* Using the DirectSound3D applet included in the DirectX 5.2 SDK, we played WAV files of different lengths and frequencies and monitored CPU utilization with system monitor.

PLUSES
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Packard Bell Multimedia 830

Boat Anchor Inside

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- Jacks on monitor for headphones and microphone
- Integrated monitor speakers reduce desktop clutter

MINUSES
- Ancient memory technology
- So slow you'll wonder if a boat anchor is inside or if you haven't turned it on
- Integrated monitor speakers reduce volume

In a school-yard fight of bottom-feeder machines, even an 85-pound weakling iMac could whoop Packard Bell's Multimedia 830. Hell, IBM's Aptiva E3N could easily extort milk money from the 830 all semester long.

Based on Cyrix's M II processor with a Performance Rating of 300, but really ticking along at 235MHz, the 830 is easily the most anemic machine to grace our test benches since the Truman Administration.

While Cyrix touts the M II 300 as a CPU comparable to a Pentium II or K6-2, we don't know how that's possible. Buried in the heart of the 830, the Cyrix chip glowed about as bright as a blue Christmas tree bulb. In fact, the M II 300 would have a hard time duking it out with a retired Pentium 200MHz desktop. Then again, it was hard to judge the M II's performance the way Packard Bell weighed it down.

Instead of 168-pin DIMM sockets that are standard in most new PCs, Packard Bell engineered it with four 72-pin sockets. It's sooo 90s. The SiS integrated chipset and video solution was also found wanting. It failed to run our most basic DirectX gaming benchmark, *Forsaken*, and bombed again in *Quake II*.

What does it do well? Certainly not office suites or creativity apps. In SYSmark98, which tests a machine's performance by loading banks of industry-standard applications, the 830 scored 52. That's nearly half the score of the IBM Aptiva E3N reviewed in the October 1998 issue. Next to the Packard Bell, the E3N looks like a shooting star. If you're looking for a cheap beginner *Photoshop* box or something to learn 3D rendering on, you'd better have patience, because this baby redefines slow when handling graphic files or rendering simple 3D graphics.

The speakers integrated in the monitor reduce desktop clutter but don't crank out enough wattage to satisfy you beyond a "You've got mail" WAV file. Sound duties are left to an ESS-1869 sound chip on the motherboard. This OEM part doesn't feature a hardware wavetable. Between the weak speakers and FM synth, MIDI music is rendered in two flavors: harmonica or kazoo.

About the only mainstream performance you'll see in the 830 comes from its Ultra DMA Fujitsu hard and UDMA CD-ROM drives. Both turned in acceptable performance for their class. The mouse is pleasantly shaped and the keyboard works.

All in all, something has to hold the bottom end of the scale and someone has to finish last in a race. Packard Bell's 830 does *that* well.

—Gordon Ung

UNDER THE HOOD

THE BRAINS	
CPU	Cyrix M II 300
L2 Cache	512K pipeline burst
RAM	64MB EDO DRAM, expandable to 128MB
Motherboard	Packard Bell, SiS chipset
Drive Bays	Two 5.25, two 3.5, and vertical mount for hard drive
I/O Ports	Two USB, two serial, one parallel, one gameport
DISPLAY	
Video	SiS 5598 integrated with system RAM
Monitor	Packard Bell 15-inch
Res/Refresh	1280x1024/60Hz
STORAGE	
I/O	EIDE integrated with chipset and VGA
Hard Drive	Fujitsu MPB 3043 4.3GB Ultra DMA
CD/DVD	Lite-On LTN-301 32x max drive
Removable	1.44MB floppy
Fax/Modem	LT PCI WinModem 56K
SOUND	
Sound	ESS-1869-based on motherboard
Speakers	Integrated with monitor

THE BUNDLE

Microsoft Windows 98, Word 97, Works | Entertainment Pack | Encarta 98 | MGI Photosuite | CyberTrio | Quicken Online | Packard Bell utilities to restore and fix rudimentary problems

BOOT 1:00 DOWN 0:03

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REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		54.9
WINDOWS APPS SYSmark 98	official score	52
HARD DRIVE HD Tach	MB/sec	8.2
CD-ROM CD Tach98	drive rating	22.8x
3D RENDERING Newtek Inspire3D	sec	1890
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	284
DIRECT3D ForsakenMark	fps	failed
OPENGL Quake2 v3.15	fps	failed

Half Moon Rising Styled like a half-watermelon, these speakers rattle when you push them and sound lifeless, despite a "bass" knob on back that must be just for looks.

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EXPANSION NOTES

PB's use of old 72-pin RAM will keep RAM prices down, but the onboard video and few PCI slots will keep a tight lid on upgrades.

EXPANSION MAP

PCI	LT Winmodem
PCI/ISA	Free
ISA	Free

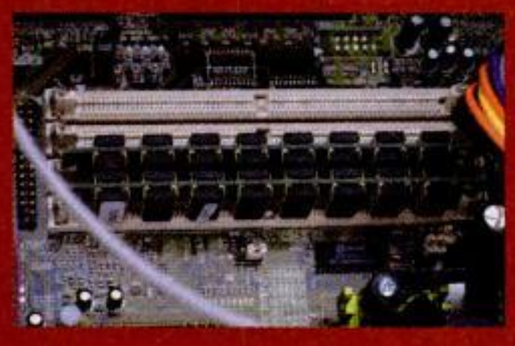
IROS

00	System Timer	**08**	System clock
01	Keyboard	**09**	Free
02	Interrupt	**10**	USB
03	Modem	**11**	Winmodem
04	Free	**12**	PS2 mouse
05	Soundcard	**13**	Num data proc
06	Floppy port	**14**	PCI bus master
07	LPT1 printer port	**15**	Secondary IDE

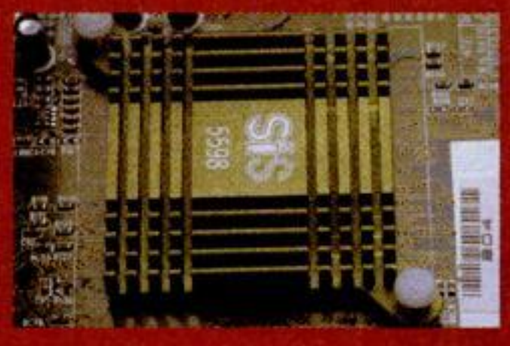
DMAS

01	Soundcard	**03**	Soundcard
02	Floppy disk	**04**	DMA controller

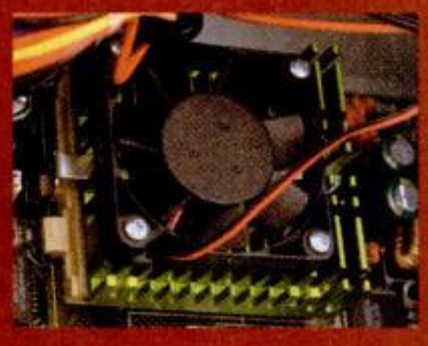
Headers on a VW Bug We know, we know. An analog modem on a PCI slot is like using a straw to drain the ocean. It's still a nice touch in the move to ban ISA.



Très 90s Even if you pretend it's 1996, these 72-pin SIMM sockets will still seem old. Especially compared to today's SDRAMs packaged in 168-pin DIMM sockets.



Three For Free SiS's core-logic chipset, VGA, and EIDE are a great bargain—for OEMS. For consumers they're not so great when the upgrade itch comes.



Is the Hamster Dead? Cyrix's M II (hiding in shame beneath this fan) isn't *completely* responsible, but we got scores so low we had to go downstairs to read them.

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We're not the biggest, so we have to be the best.

CADALYST LABS
4 1/2 STAR RATING
Nov. 1998
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Xeon Rackmount

ISP PRIMA EDITOR'S CHOICE
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Xeon Workstation

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PCComputing
November 1998
Xeon LVD Raid

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- (1) Intel Xeon 400Mhz Processor
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- Slots: (6) PCI, (1) ISA, (1) AGP
- Sound & Ethernet 10/100 by Intel
- Matrox G200 8MB AGP 2X Video
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STA DUAL PII 450/BX

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- 64MB SDRAM
- Slots: (5) PCI, (2) ISA, (1) AGP, BX chipset
- 9GB 7200RPM Ultra-33 Drive ST39140A
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- Keyboard, Floppy, Mouse
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STB PII 400/BX

- (1) Pentium II 400Mhz w/512K
- 64MB SDRAM
- Slots: (3) PCI, (2) ISA, (1) AGP, BX Chipset
- 9GB 7200 RPM IDE Drive ST39140A
- Diamond Nivida TNT 16MB AGP 2X Video
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- 32x CD-ROM
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- Keyboard, Floppy, Mouse
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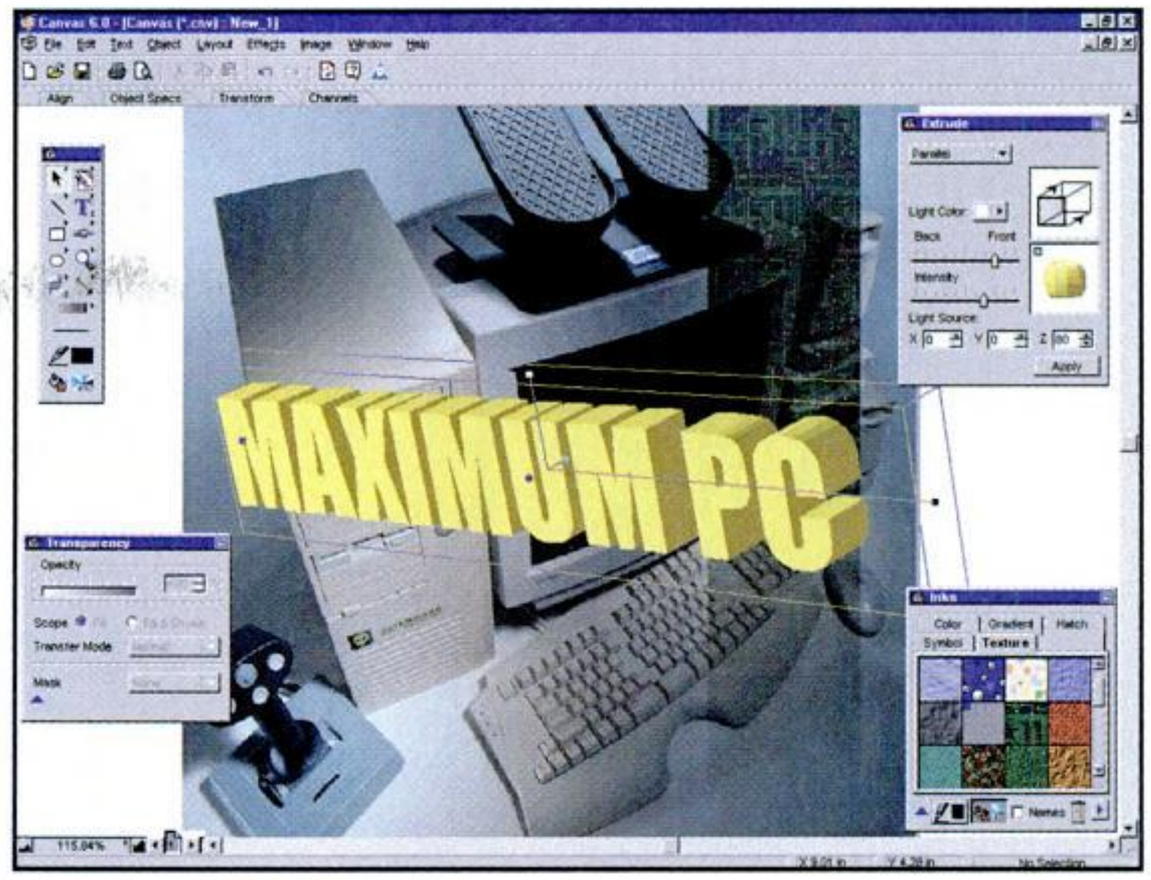
Canvas 6.0

The ultimate sofabed



Deneba has done what Adobe has refused to do: unify graphics apps. This conglomeration mixes every metaphor a designer might ever conceivably need, but versatility comes at a price. Just as a sofabed rarely satisfies completely as either sofa or bed, *Canvas 6.0* has a few rough spots.

From the top, Canvas 6.0 is: a vector-based illustration, raster-based image-editing, technical CAD/CAM drawing, 3D-graphics, page-layout, presentation, and web-design jack-of-all-trades. Amazingly, it wears all these hats smartly.

Spotlighted with version 6 is the SpriteLayer. This allows designers to layer, blend, and composite not just raster images, but also vector graphics and unconverted text. Now all these diverse flavors of elements can be manipulated in a single document in a single pass. The SpriteLayer's transparency effects are reminiscent of the latest version of *FreeHand*. But now type, line art, and continuous-tone imagery can all have varying degrees of transparency applied.

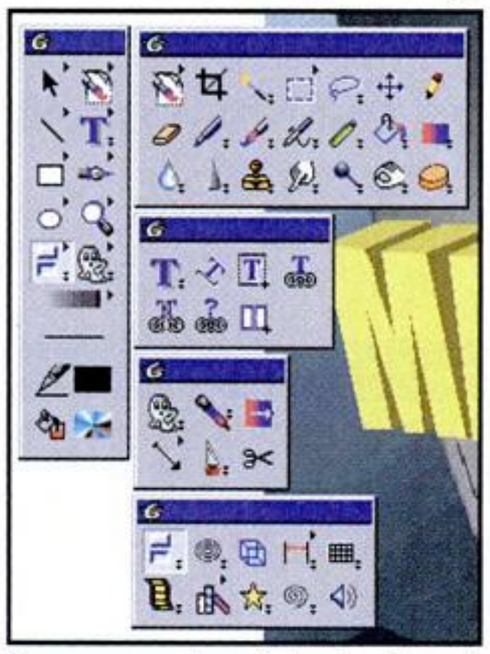
As an image-editing app, *Canvas 6.0* accepted all the *Photoshop*-compatible plug-ins we threw at it. And familiar tools such as dodge and burn, clone, smudge, and blur are in effect, as are all filters and controls. *Photoshop* Acquire modules also work with 6.0, so getting images into the program shouldn't be a problem. And with this year's model, *Canvas* preserves layers when importing *Photoshop* files.

But don't mistake *Canvas* for *Photoshop*, which was our 1998 Graphics App of the Year. Deneba's implementation lacks the grace of Adobe's knowing touch. For example, *Canvas 6.0* doesn't include a zoom-in preview for filter effects.

If you want extruded 3D type, look no further. Though primitive, this handy effect lets you customize your light-source color and position (although we'd like a focal-length adjustment for extreme perspective). And these can be applied to extruded and lathed 3D shapes based on your vector graphics, as well.

Bringing together all the graphics app genres, Canvas 6.0 is the most lovable mutt since Benji.

The vector abilities are very robust. *Canvas* has all the tools you'd expect of an illustration app, with bonus widgets thrown in for fun. Plus, any combination of attributes can be pasted from one object to another, and object-attribute style sheets can be created that streamline workflow significantly.



Everyone wants a full selection of tools, but some of these are mighty alien. And what's with that ghost tool?

The more powerful drawing tools elevate *Canvas* into a rudimentary CAD/CAM app. Scale can be set for mechanical drawing, and dimensions for objects can be entered numerically. Special dimensioning tools let you measure and label any part of your schematic, and a SmartMouse feature constrains mouse movement in 12 user-definable ways. This feature takes half the challenge out of basic CAD.

In addition to these mainstay uses, *Canvas 6.0* includes web tools (see sidebar), page-layout abilities that include support for CMYK separations (with full trapping preview), multipage documents, auto text flow in columns, and a customizable spell-check dictionary. Did we mention that the program also comes with 30,000 clip art pictures, 2,450 fonts, and a 30-minute video?

But this breadth has drawbacks. *Canvas 6.0*'s deeply nested tear-off tool bar is rife with unfamiliar (and sometimes downright bizarre) icons. And the lack of a true Layers palette makes managing all the diverse elements of more complex documents into a nightmare.

Still, none of this holds back this program's do-it-all attitude, especially at a price less than half that of the household names in graphics apps. *Canvas 6.0*'s unique ability to combine disciplines will lead the designer down previously inaccessible creative paths.

—Brad Dosland

PLUSES

- 7 apps in one!
- SpriteLayer composites like no other program can
- Imports Photoshop files with layers intact
- Many unique widgets

MINUSES

- Not as good in any single area as a dedicated app
- Nonstandard interface has learning curve

THE SPECS

REQUIREMENTS

- Pentium processor
- 12MB of RAM
- 20MB hard disk space
- Windows 95/NT

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TAKE IT ONLINE!

More and more, this is an online world, and while Adobe sells the web tools that belong in *Photoshop* as a stand-alone app, *Canvas* includes the grit to get your images on the web. The program's Colada module can create sophisticated web files, complete with image maps and Java-based roll-overs and animations. Version 6.0 adds support for the up-and-coming PNG format, in addition to the program's existing support for GIF89a. Your image's palette can even be optimized for faster download times. And best of all, Colada-created pages can be viewed in any modern browser, with no additional plug-ins required. While the execution of these features can't measure up to those found in *FreeHand*, many—such as the embedded Java effects—are unique to this particular graphics app and perhaps Macromedia's *Fireworks*.

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NEC Versa LX

The silver surfer

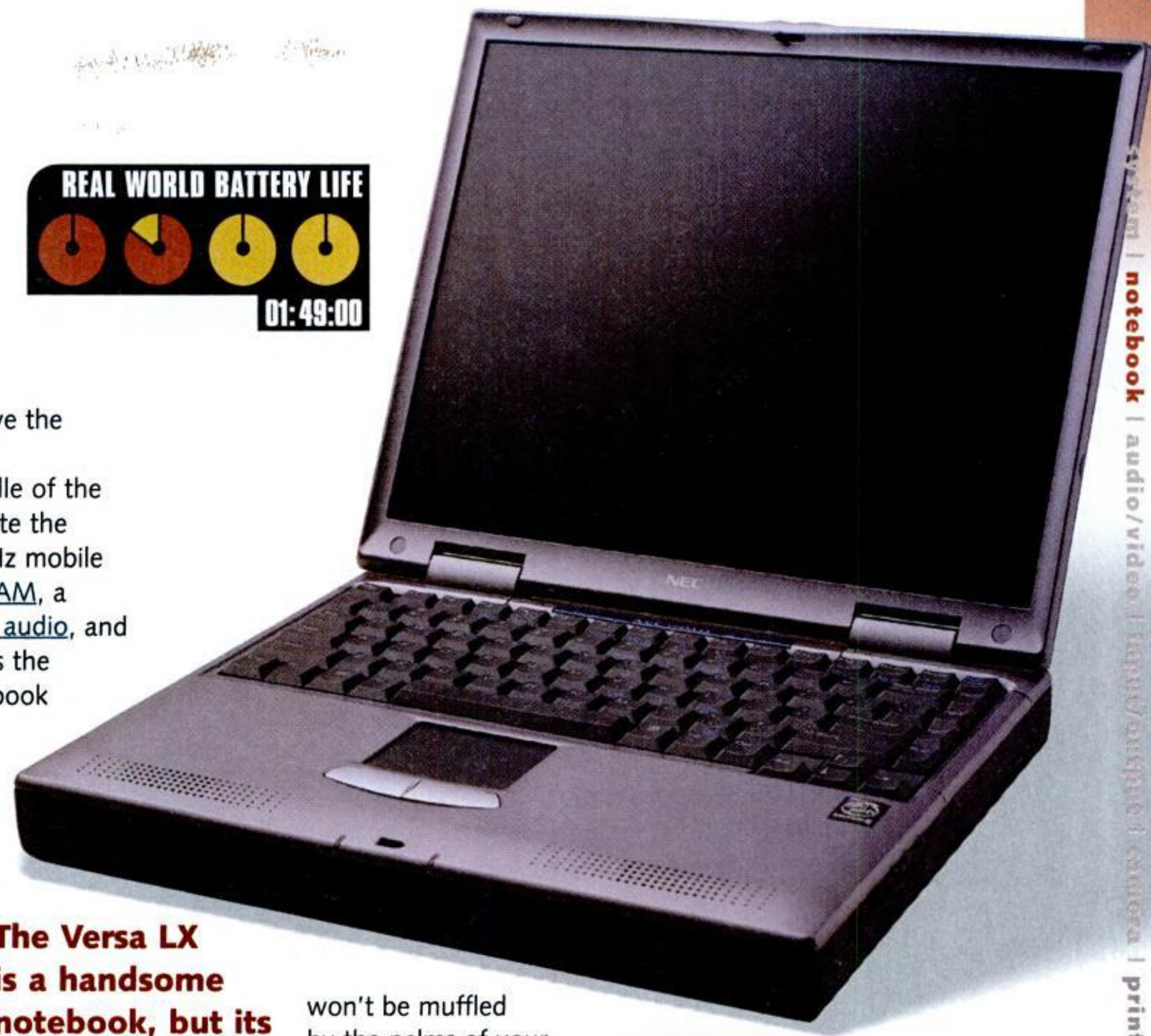
It's getting mighty hard to differentiate notebook PCs these days. All the great ones include Intel's macho mobile Pentium IIs (266MHz and beyond), ATI's awesome 3D Rage LT Pro video chip, decadent DVD, a bitchin' built-in modem, and a big screen with bad-ass sound.

PLUSES
- Mobile Pentium II
- Beautiful 14.1-inch display
- External volume control
- Simultaneous DVD/floppy
- Slick silver case

MINUSES
- No built-in modem
- Poor speaker placement
- Single USB port

So where does this leave the Versa LX?

Smack-dab in the middle of the pack, unfortunately, despite the inclusion of Intel's 266MHz mobile Pentium II, 64MB of SDRAM, a 14.1-inch TFT, wavetable audio, and a DVD-ROM drive. This is the fourth 266MHz P-II notebook we've tested, and compared to the benchmark scores of other notebooks we've reviewed, the Versa LX performs, well, right in the middle of the pack. None of the subsystems are particularly bad, but none are exceptionally great either. Even the bundled Margi DVD PC accelerator card performs on par with other—completely integrated—solutions we've seen, with only minor artifacting and stuttering. Framerates hold steady at 30fps, with both RCA and S-Video-out ports included for television viewing audiences.



The Versa LX is a handsome notebook, but its overall attraction is marred by a few design flaws and middle-of-the-road performance.

There's no denying the Versa LX's sleek silver styling is a major turn on. (How can you not appreciate its two-toned, tough, scratch-resistant, brushed-polycarbonate finish?) But if aesthetics are your only cup of tea, go buy yourself a box of Twining's. If it's a potent portable you're after, the Versa LX could do with a couple of quick changes.

For starters, ditch the PC card modem with the omnipresent X Jack—we prefer them built-in. Second, add a (strangely absent) second USB port. And how about shoring up the paper-thin TFT to reduce overt amounts of flex, and relocating the speakers so they won't be muffled by the palms of your hands while you're busy tap-tap-tapping away on the keyboard? Of course, with NEC's direct-order model, you can customize some of the features, such as increasing the hard drive capacity or adding a SuperDisk, but the fundamental design flaws exist regardless.

That said, we're still mighty impressed by the lucidity of the 14.1-inch TFT and its excellent off-axis viewing. The keyboard is also a beauty, with full-sized keys and pleasant tactility. We also appreciate the external volume control—an option seldom seen these days—and the one-touch button to monitor remaining battery power.

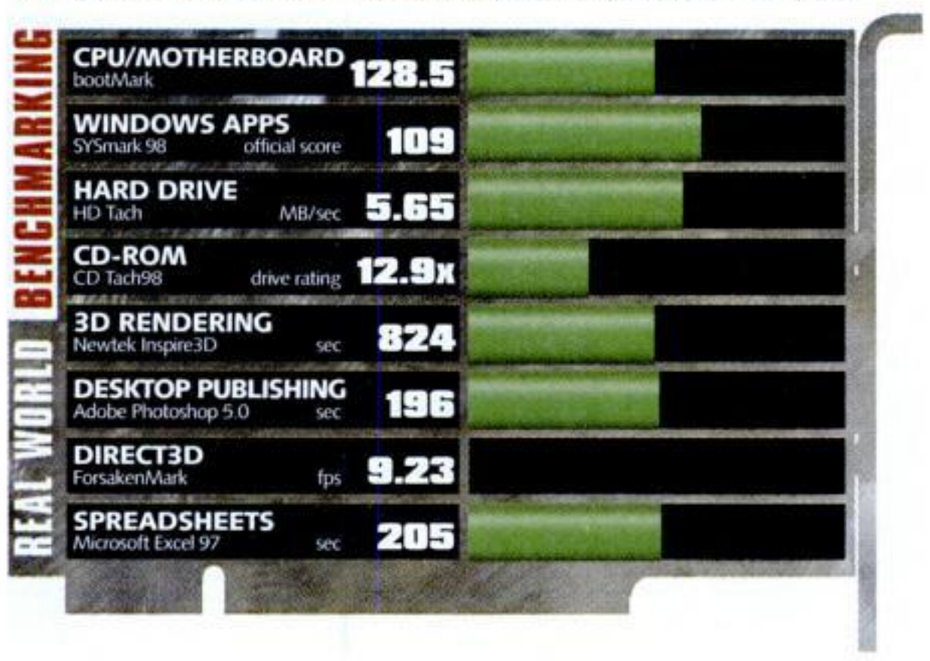
The Versa LX is a good notebook, but not great. But hey, did we mention it was silver?

—Bryan Del Rizzo

UNDER THE HOOD

THE BRAINS	
CPU	266MHz Intel mobile Pentium II
RAM	64MB SDRAM (expandable to 128MB)
I/O Ports	Single PS/2, single USB, S-Video-out, RCA-out, port replicator, parallel, serial, audio-in, audio-out, dual PC card, IrDA
Modem	56K PC card modem with X Jack
DISPLAY	
Videochip	ATI 3D Rage LT Pro with 4MB VRAM
Display	14.1-inch TFT
Res/Color Depth	1024x768/32-bit
STORAGE	
Hard Drive	Toshiba 3.2GB EIDE hard drive
CD-ROM	Matsushita 24x EIDE DVD-ROM drive
SOUND	
Sound	ESS Maestro wavetable/FM audio
Speakers	Stereo speakers

BOOT 0:58 DOWN 0:07


REAL WORLD BENCHMARKING
CPU/MOTHERBOARD bootMark 128.5
WINDOWS APPS SYSmark 98 official score 109
HARD DRIVE HD Tach MB/sec 5.65
CD-ROM CD Tach98 drive rating 12.9x
3D RENDERING Newtek Inspire3D sec 824
DESKTOP PUBLISHING Adobe Photoshop 5.0 sec 196
DIRECT3D ForsakenMark fps 9.23
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Trespasser

Sometimes extinction is the best thing

Years in the making, *Trespasser* was to be the crowning achievement of realtime software terrain rendering, uniting an über-realistic physics engine with a first-person adventure filled with detail. DreamWorks got the physics engine right, but the graphics and interface are horrid.

THE SPECS

3D CARD SUPPORT
Direct3D

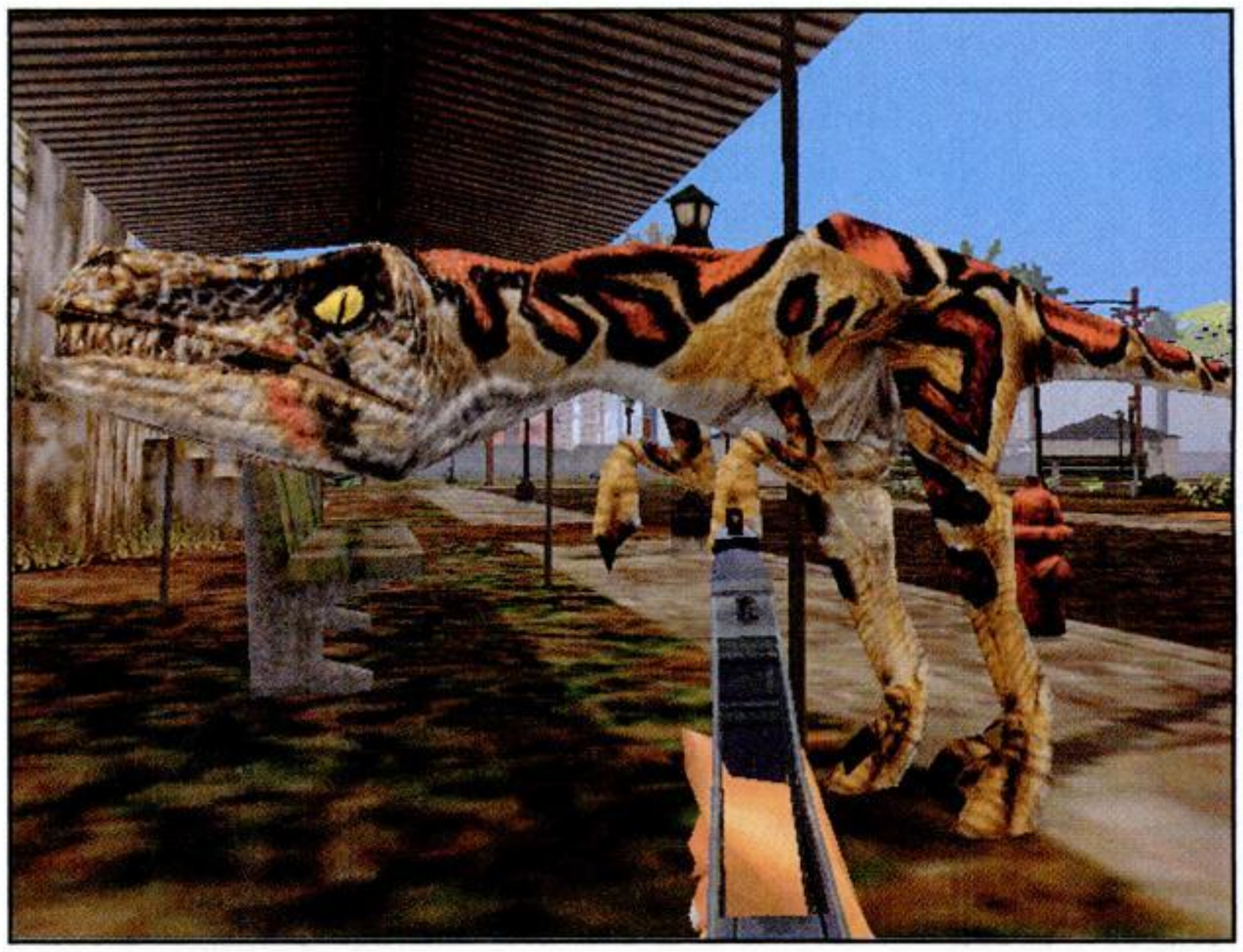
SOUND SUPPORT
Aureal A3D, Creative Labs EAX

PLUSES
- Excellent physics engine
- New level of interactivity
- Runs in software mode with a 1MB videocard
- Software bump-mapping

MINUSES
- Runs like crap except on a bad-ass machine
- Horrible LOD and mip-mapping resulting in pixelated graphics
- No filtering on dinosaurs means pixelation
- 3D acceleration is used, but not enough
- Horrible clipping problems
- Software rendering dithers graphics
- Hand control has a long learning curve
- Hard to aim weapons

The *Trespasser* story is the official sequel to the Lost World movie series. You play as Anne, an uninvited guest who crash-lands on InGen's Site B. You must find a way off this texture-mapped Tropicana without winding up in a Velociraptor's belly.

Trespasser's mixture of hardware and software rendering is both breath-taking and bilious. The terrain is a source of beauty, in the form of texture-mapped polygon plants, trees, and rocks, although some are implemented effectively as brushes. The bile begins to fly when the terrain violently distorts with the drastic level of detail (LOD) changes. Textures slide about on their polygon frames, and the flora and fauna jerk about as a result of sloppy mip-mapping. Pixelated trees suddenly snap into detail as you approach. Ground textures look fine up close, but mountains wallow in repetitious tiling, and the persistent horizon fog fails to mask the on-screen redraw, breaking the immersion.

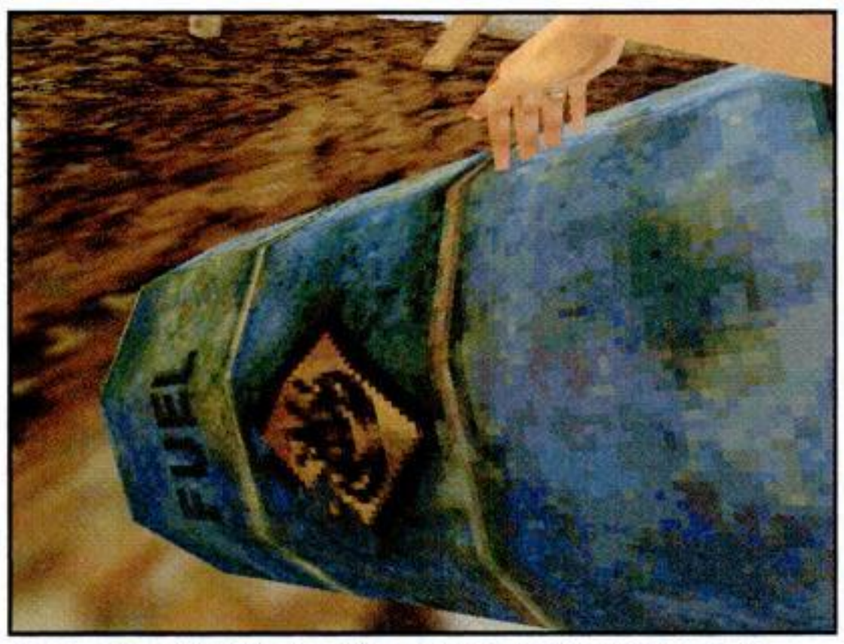


Those deadly dinosaurs are back, but pixelated, in DreamWorks' Trespasser.

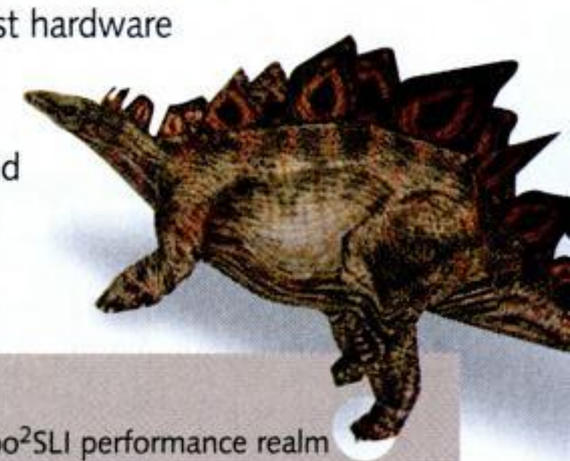
The critters, on the other hand, are a whole different story. The skinning process used to texture-map those 350-polygon dinosaurs results in smoothly mapped and realistically animated creatures. Particularly well done are the raptors, with their spooky side-to-side head movements and lunges. While software renders muy cool bump-mapping on these dino skins, you'll have to swallow the engine's pixelated point sampling.

Software rendering generates hideous dithering artifacts. Even with hardware acceleration, only the terrain and scant few objects employ bilinear filtering, most remain point-sampled, creating a schizo visual presentation.

But all this rendering comes at a price. *Trespasser*'s floating-point computations and reptilian rendering steals the System Hog prize from *Unreal*. Forget what the packaging says: Unless you have a Pentium II/Xeon or K6-2, *Trespasser* will be lucky to break double-digit framerates. Don't expect an arcade-quality 60fps with *Trespasser*. Under even the absolute best hardware conditions, *Trespasser* chugs around 20fps.



Anne can certainly grab those drum barrels real good!



SOFTWARE VS. HARDWARE RENDERING

Seamus Blackley, Trespasser's Project Leader, has been outspoken about his general dislike of current 3D-accelerator technology. Trespasser was going to show the world that with clever programming, you can perform on par with 3D accelerators in speed and visual performance. When we spoke with him during development in 1997, Blackley said, "Rendering features—such as the one that allows *Trespasser* to draw 30,000 trees at 20fps or stretch skin over a dinosaur skeleton—are simply unsupported on today's 3D cards."

After running *Trespasser* on a variety of systems, we can safely say that it requires a high-end 3D accelerator in the TNT/dual-Voodoo²SLI performance realm to get optimal 20fps performance.

Even on the fastest DirectDraw 2D cards, Trespasser's framerates bogged down like a sloth in a tar pit: pitifully slow and unplayable.

Sorry, but software rendering just doesn't cut it.

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Still, the physics engine in *Trespasser* and its level of interaction are the most advanced ever in a first-person adventure game. The unique disembodied arm interface is both fascinating and frustrating. You control your arm via mouse movements and mouse-clicks, and anything can be grabbed, carried, or thrown, with realistic gravitational properties. But that doesn't stop objects from occasionally floating in mid-air. Also, Anne must be the Incredible Hulk's sister, because she can hoist some hefty oil drums with only one hand! And just how can Anne grab those smooth oil drums and massive wooden crates with no handles in sight? She must have a gekko in her family tree too.

This interface takes getting used to and doesn't lend itself to certain action, such as aiming a jeep-mounted machine gun. You'll accidentally drop items constantly in *Trespasser*: whether you're running up a hill or opening a door, the engine frequently collides the object you're carrying with terrain and promptly rips it out of your hand. And when you run around, the arm movement is laughably silly looking. As you twist your arm about, gun stocks pass right through your arm, demonstrating *Trespasser*'s abundant clipping problems. And getting stuck in doors and railings only adds to this frustration.

Hardcore gibaholics need not apply—*Trespasser* is a single-player adventure game, first and foremost, with a heavy emphasis on exploration and object manipulation. But dinosaur skull-cracking via high-powered weaponry does occur sporadically. Each species has its own AI-determined behavior, so you can sit back and watch these massive beasts wander about the landscape foraging for food (which is often you).

The 3D sound is one of the few things *Trespasser* does well. Tromping through the wooded glades inundates your ears with bird chirps, wave crashes, and the occasional stomping of Brachiosaurs. And with the proper A3D or EAX four-speaker hook-up, that massive T. Rex will hunt you down and fill your rear speakers with roars of hunger and thundering footsteps.

Despite all the intriguing new concepts and detail brought to the gaming table by this ambitious project, including the awesome sound and an impressive dinosaur AI, *Trespasser*'s few accomplishments are buried under a mountain of technical glitches, visual grossness, and undue steep performance requirements.

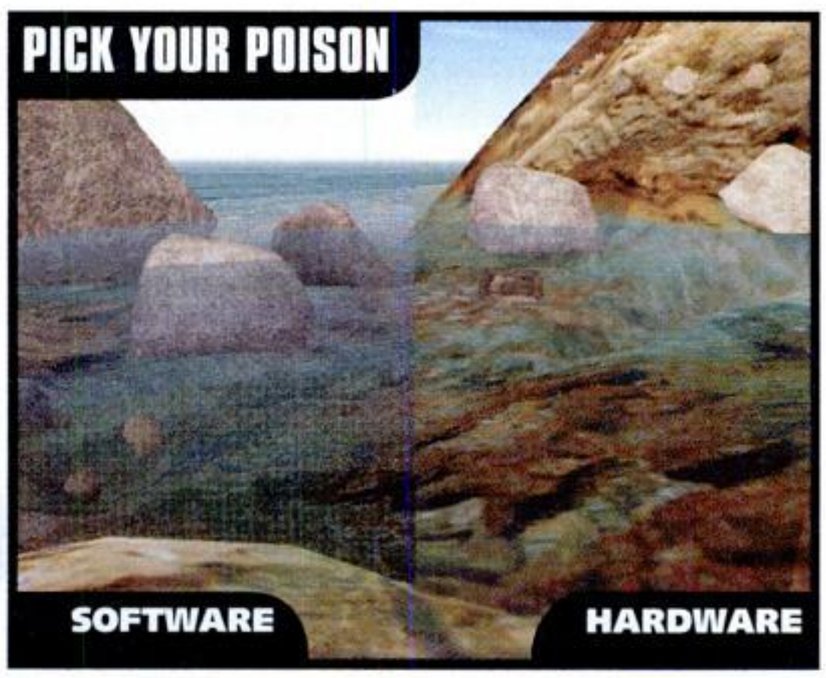
As the original movies set out to prove, some things are better left extinct.

—Andrew Sanchez

MIP-MAPPING MAYHEM

The tree on the left looks the way all terrain should look in Trespasser, but take one step back and... BAM! Shoddy mip-mapping replaces it with the atrocity on the right.

PICK YOUR POISON



On the left is Trespasser's much vaunted software rendering. Note the dithering artifacts and blocky textures. On the right is 3D output via a Voodoo Banshee: dig the smooth filtering and clear water.

MAXIMUM PC VERDICT

Price $50
Developer DreamWorks Interactive
Publisher Electronic Arts
Phone 800.245.4525
URL www.dreamworksgames.com

3

WHAT YOU CAN EXPECT FROM YOUR SYSTEM WITH TRESPASSER

We ran *Trespasser* on a few systems and came up with some general guidelines on how to set up your resolution for maximum dino appeal. These are general settings with the quality and screen-size slider set to maximum—feel free to tweak the texture-quality slider and screen size in the Visual Options menu to get a perfect performance fit. Smooth framerates are sustained during normal adventuring sans dinosaurs, but bog down to single digits with one or more beasties on-screen, regardless of resolution or setup.

- **Pentium 200MMX** with 32MB of EDO DRAM and Rendition V2200 (4MB) and 3Dfx Voodoo² (8MB)

  Videocard driver: software renderer/Voodoo² driver
  Recommended resolution: 320x200/640x480 (medium texture resolution)

- **Pentium II 233MHz** with 64MB and Cirrus Logic 546X AGP (1MB)

  Videocard driver: Software renderer
  Recommended resolution: 320x480

- **AMD K6-2 300MHz** with 64MB of SDRAM and nVidia Riva 128 (4MB)

  Videocard driver: Primary Display Device
  Recommended resolution: 512x384

- **Pentium II 350MHz** with 256MB of SDRAM, nVidia TNT (16MB) and dual-Voodoo² SLI (12MB)

  Videocard driver: Voodoo² driver or TNT
  Recommended resolution: 640x480 (TNT), 800x600 (Voodoo²)

- **Pentium II Xeon 450MHz** with 128MB of SDRAM and nVidia TNT (16MB)

  Videocard driver: Primary Display Device
  Recommended resolution: 800x600

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Football Four Play

Out of three vets and a rookie; who's gonna make the play?

Snow on the ground, a bite in the air, blood on the grass—must be football season again. What better way to spice up the long, slow nights of winter than with a handful of pigskin pandemonium? This month we take a time-out to tackle the biggest names in simulated gridiron, both college and pro ball. Line 'em up, hit 'em hard, and knock 'em down.

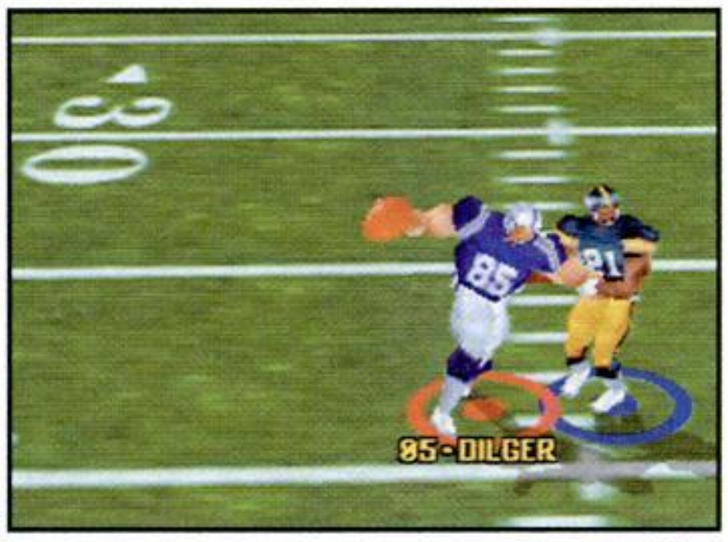
—Phil Lacefield Jr.

NFL Blitz

More often than not, conversions of popular console or arcade games ported to the PC suffer from poor gameplay, stinky graphics, and sounds that just aren't the same. This is not so with *NFL Blitz*.

A direct translation of the hot arcade classic, *NFL Blitz* comes to the privacy of your home system with every detail of the original intact. Oh, sure, you never really get to see the stadiums, and the players are shaped a lot like your old He-Man action figures, all lumpy and bumpy. And yes, the controls are ridiculously simple and easy to master, the soundtrack is heavy with trash talk, and the playbook is frightfully slim—all attributes we've come to know and love in our favorite stand-up quarter robbers.

But holy cow, what fun! Your eyes will scarcely believe the titillating display before them, as players smash and grind in gorgeous 800x600 accelerated harmony. All manner of 3D cards are happily supported, and framerates range from 30 to 50 with every run-and-shoot you see. There are no rules, no penalties, no pesky refs to get in the way, just good, clean, wholesome bodily harm and bloodletting. Cheerleaders don't parade out for halftime entertainment, but that's more than made up for by the always-entertaining ability to body slam your opponent seconds after the whistle. Take that!



Fortunately, injuries like this soon-to-be painfully dislocated shoulder don't affect gameplay.

Controls for one or two players on the same system are a cinch (sorry, no LAN or Internet play for you!), although four-player support like the original arcade version would have been nice. A decent selection of 18 offensive and defensive plays can make hash out of almost any opposing line, and choices can be hidden from your same-screen opponent at any time.

In NFL Blitz, you'll make first downs the old fashioned way—you'll bleed for them.

The pesky announcer calls out a few accurate names from each team on almost every play; a good thing too, since everyone throws, runs, and tackles like everyone else. System requirements are fairly modest, so nearly everyone can join in the fray, but a beefy processor and a 3Dfx card are the only true way to appreciate this little monster.

The only problems we identified were annoying at worst. The soundtrack is heavy on bass and low on quality, making most subwoofer sets pop and crackle like a cheap boom box. And the removal of the play editor included with the Nintendo 64 version of *NFL Blitz* is an abomination, since there's no reason every available feature on a console game shouldn't be included in a PC version. A season mode is provided to keep track of your own personal 16-week punishment lessons, but saving games is nearly impossible once the clock starts. Be prepared to finish your games out to their bitter end, every time.

NFL Blitz makes no claims about stat management, player drafts, dynasty building or any other namby-pamby front-office crap. This is a game, not a simulation, and tossing aside those frilly extras leaves the door wide open for rock-'em-sock-'em fun for hours on end. We haven't had this much fun since *Asteroids* went color way back when. Save up those quarters for a few days and plunk them down at your favorite software counter in exchange for this worthy investment, and you might actually find yourself staying home and sitting down at a game for a change.

MAXIMUM PC VERDICT

Price $50
Company Midway
Phone 903.874.5092
URL www.midway.com

8

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NFL GameDay 99

Some PlayStation ports triumph, others fail. 989 Sports' *NFL Gameday 99* is middling: when it's good, it rocks; when it's bad, it stinks.

3D acceleration is mandatory, and it pays off with killer player animations, signature jukes and spikes, and framerates in the high 30s. An easy-to-master interface allows for easy play changes at the line, something that comes in handy when playing seven other players at once (four per side, the way God meant football sims to be).

Dick Enberg and Phil Simms dish out the usual witty banter of "Wow!" and "He really blew that one!" every time Chris Blake screws up another Bengals drive, which is fairly often.

It's a good thing this lousy play can't be recorded for future blackmail.

Gameplay is fast and furious, but it all suffers from a disturbing lack of common features, such as a save-game utility, a custom play designer, special teams, even league and multiple-season stats. Hey, want to trade players? I'll give you my Steve Young for your fourth-string guard, and forget about the economics or post-season placement.

Fortunately, *GD99* stocks the only usable Internet multiplayer option of this group, although weak and laggy, through Sony's very own 989studios.net game-finder servers. A pretty picture, but who goes to The Game to look at the pretty colors? Sorry pal, looks like you're sitting this quarter out.

MAXIMUM PC VERDICT

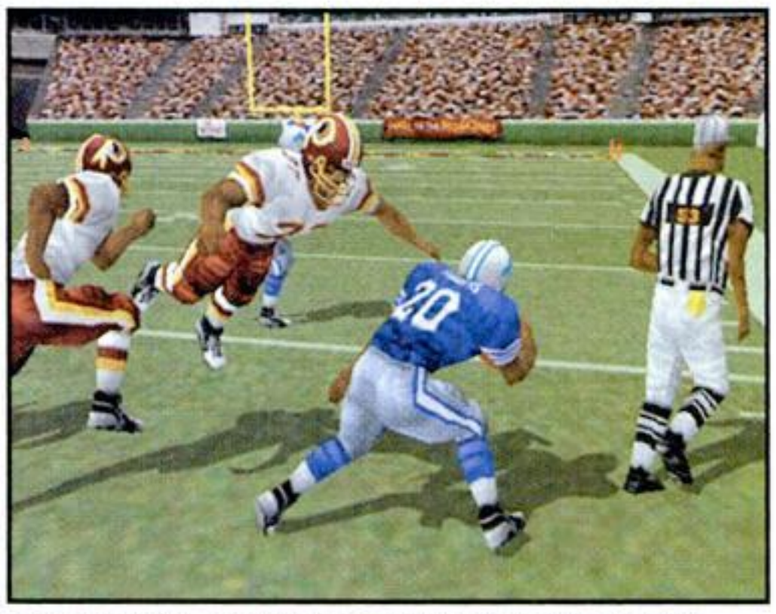
Price $40
Company 989 Sports
Phone 888.426.3702
URL www.989sports.net

6

Madden 99

Football legacies are rare and special, and rabid fans of the venerable Madden series know a good gig when they see one. *Madden 99* notches up several impressive graphical improvements to the series, while omitting little in the way of expected features.

The players are finally polygonal, with more than 1,000 polys apiece, banishing sprites to the history books. Glide and Direct3D support make for silky-smooth tackles and replays, but animations are still just a little weird, moving like no other football team we've seen. Signature moves are well-modeled, though (no other human throws a bomb quite like Brett Favre). And why would a game with such a ferocious worldwide following ship with four-player network support, but no built-in head-to-head Internet play options? Strange.



Not even the occasional pesky ref or Flying Red Man can stop Barry Sanders!

Pat Summerall and Madden himself keep commentary lively and fairly accurate, and the usual plethora of custom team and player design tools make *Madden 99* a strategic godsend for those with an eye toward micromanagement. A new one-button gameplay feature helps newbies jump right into the fray with minimal fuss, and the Madden 101 CD included with the game is a treasure trove of NFL facts, history, and strategy.

Aside from a few wiggly quirks, *Madden 99* marks yet another one up for the record books.

MAXIMUM PC VERDICT

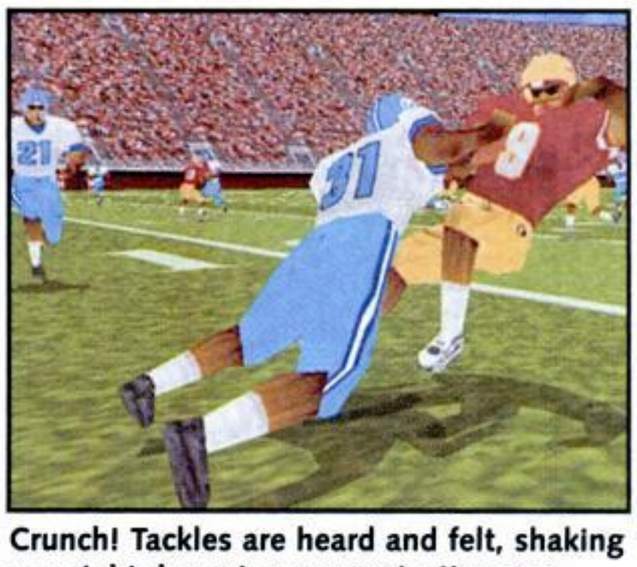
Price $55
Company EA Sports
Phone 800.245.4525
URL www.easports.com

8

NCAA 99

Finally, a football game for those of us still stuck in *Animal House* frat-boy stage. A notable first for college fans, *NCAA 99* lines up each and every Division 1-A team and stadium for gridiron mayhem, with a couple dozen bowl games and classic rivalries thrown in for good measure.

Players can be recruited, dynasties formed, playbooks configured—all with relative ease, and the historic matchups are a blast for even the novice fan.



Crunch! Tackles are heard and felt, shaking you right down to your protective cup.

Framerates in the high 20s and excellent 800x600 3Dfx graphics help keep things looking pretty cool, with the exception of the cardboard-cutout sideline players and staff.

LAN play works great, but the AI needs work, refusing to learn from oft-repeated moves (the shotgun with one wide out gets 'em every time), and receivers drop balls most schnauzers could bust wide open and score. When combined with mediocre player animations and the total lack of Internet play options, *NCAA 99* gets left in the dust. The manual might as well not even be there for all the info it provides—where are you going to learn all those subtle differences between college and pro rules? Go figure.

Designed from the ground up as a partner to the venerated Madden series, *NCAA 99* still needs AI work and motion-capture two-a-days to be a contender.

MAXIMUM PC VERDICT

Price $55
Company EA Sports
Phone 800.245.4525
URL www.easports.com

5

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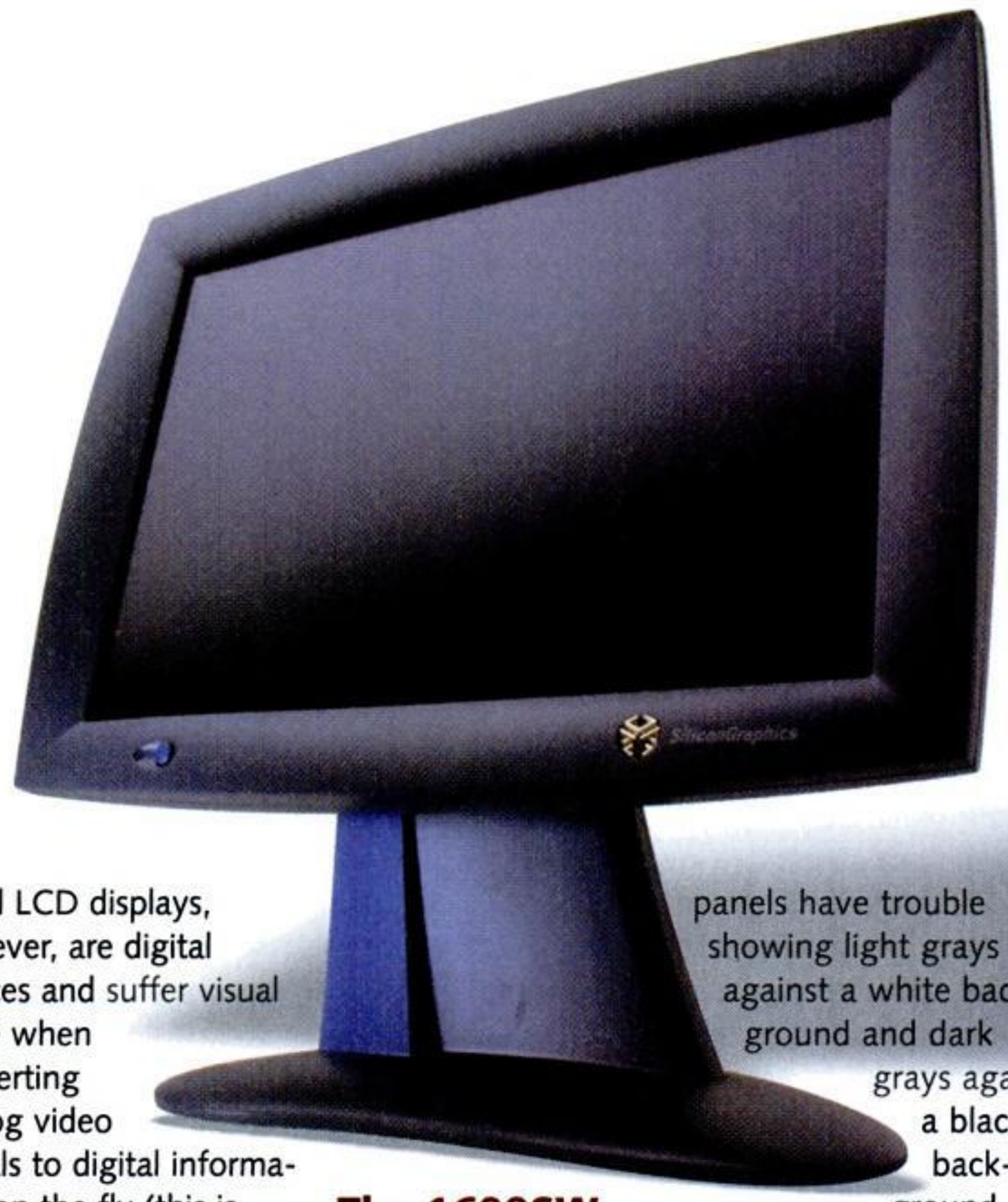
SGI 1600SW

Flat-out, the best monitor ever



MAXIMUM PC KICK ASS! product

The 1600SW is a breath-taking monitor that offers all the benefits of a slim, thin flat panel along with the exquisite visual quality of a high-end CRT. SGI essentially looked at the specs mustered by the best flat-panel competitors and surpassed them feature-by-feature:

THE SPECS

FOOTPRINTS
17.8x18.3x7.3-inches
16 lbs.
17.3-inch diagonal viewable

RES/COLOR DEPTH
1600x1024 max
True 24-bit color

INTERFACE
36-pin OpenLDI digital

TFT MANUFACTURER
Mitsubishi

PLUSES
- Digital interface
- Bundled 32MB videocard
- Highest res available
- Big screen
- Wide aspect ratio
- True 24-bit color
- Excellent grayscaling
- Bright, bright, bright
- No geometric distortion
- Very low heat

MINUSES
- Slight high-contrast streaking

▶ **Resolution.** Today, almost every panel selling does 1024x768, and a small handful do 1280x1024, but the 1600SW does 1600x1024, a resolution that meets CAD and photo-imaging requirements.

▶ **Pixel pitch.** Today's best panels top out at 90 pixels per inch, but the 1600SW boasts 110. The extra pixels provide that much more visual information for a higher-definition picture.

▶ **Screen real estate.** The 1600SW offers 17.3 diagonal inches in a daring 16:10 aspect ratio to accommodate two 8.5x11-inch pages side-by-side. Other panels offer 18.1 and 20.1 diagonal inches, but stick to the traditional 4:3 aspect ratio and cost anywhere from $500 to $2,900 more.

▶ **Color depth.** The 1600SW offers true 24-bit color depth for 16.7 million colors. Other panels claim 24-bit, but cheat, which results in dithering.

▶ **Interface.** Traditional videocards employ an analog interface, which is de rigueur for CRT monitors. Flat-panel LCD displays, however, are digital devices and suffer visual noise when converting analog video signals to digital information on the fly (this is arguably the number-one problem with flat-panel LCD performance). The 1600SW circumvents the analog-to-digital conversion process with an amazing bundle: For $2,800, you get not only the panel itself but also a pure digital interface care of Number Nine's 32MB Revolution IV-FP videocard. The upshot? Pristine, fuzz-free text and images.

The 1600SW leapfrogs over all other panels to challenge the best CRTs.

Of course, all this cutting-edge hoo-hah doesn't mean jack unless you can see a better picture with your own two eyes. Believe this: The 1600SW is like no other monitor—CRT, LCD, or otherwise—you'll ever see. Text is razor-sharp down to 6-point type. Color saturation is bright, lush, and consistent from edge to edge. Grayscaling is the best we've ever tested; most flat panels have trouble showing light grays against a white background and dark grays against a black background, but the 1600SW masters the full grayscale range, even outperforming excellent CRTs. And like all flat-panel LCD displays, geometric distortion isn't even an issue because the 1600SW's pixels are defined by a fixed grid. During *DisplayMate* testing, our test panel had only a single flaw: slight streaking jutting from areas of high contrast.

We cannot overemphasize the 1600SW's performance. This baby is the future of desktop displays, and the best monitor we've ever seen.

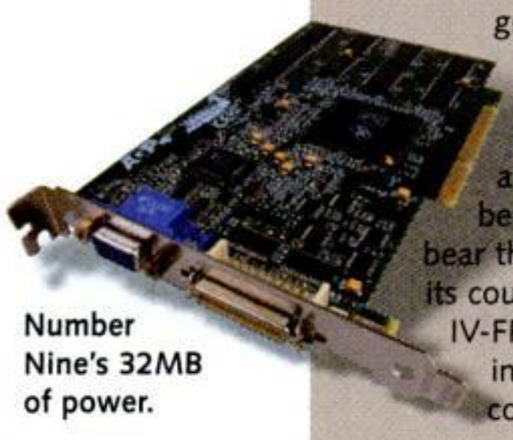
—Jon Phillips

MAXIMUM PC VERDICT

Price $2,800
Company SGI/Number Nine
Phone 800.438.6463
URL www.sgi.com

10

THE DIGITAL REVOLUTION



Number Nine's 32MB of power.

With 32MB of SDRAM, dual 128-bit graphics engines, and support for DirectX 6, OpenGL, and Heidi, the Number Nine Revolution IV-FP looks to be a great workstation warrior; benchmarks might eventually bear this out. But when it comes to its coupling with the 1600SW, the IV-FP gets high marks for its interface support and software control panels.

The card has a traditional 15-pin analog video output along with a 36-pin digital OpenLDI connector. Other flat-panel vendors are moving toward the competing PanelLink interface, but SGI said OpenLDI is the only interface that can currently support 1600x1024 and higher resolutions. Said SGI's Display Products Manager Josh Larson-Mogal: "We weren't willing to wait for dozens of other companies to debate a standard. Innovation shouldn't be held up for politics. But, we'll adhere to any standard that works for the technological demands of our product. We'll get in line with everyone else."

The IV-FP also comes with a helpful Display Properties control panel that includes adjustments for backlight brightness, gamma, color temperature, and color calibration. These pro-level controls mitigate the fact that the 1600SW is completely devoid of on-screen controls.

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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3-D ULTRA

NASCAR® PINBALL

Pull the plunger, put the pedal to the metal and race to the checkered flag. **3D Ultra NASCAR® Pinball** combines the thrill of NASCAR® racing and the fast-flipper action of pinball into wild bumper-to-bumper fun.

- Includes NASCAR® greats Dale Earnhardt, Bill Elliott, Terry Labonte and Bobby Labonte
- 3-D Ultra Pinball Quality, including extra wide tables, no scrolling and dynamic ball physics
- Stunning 3-D graphic animations–including motion-capture pit crews

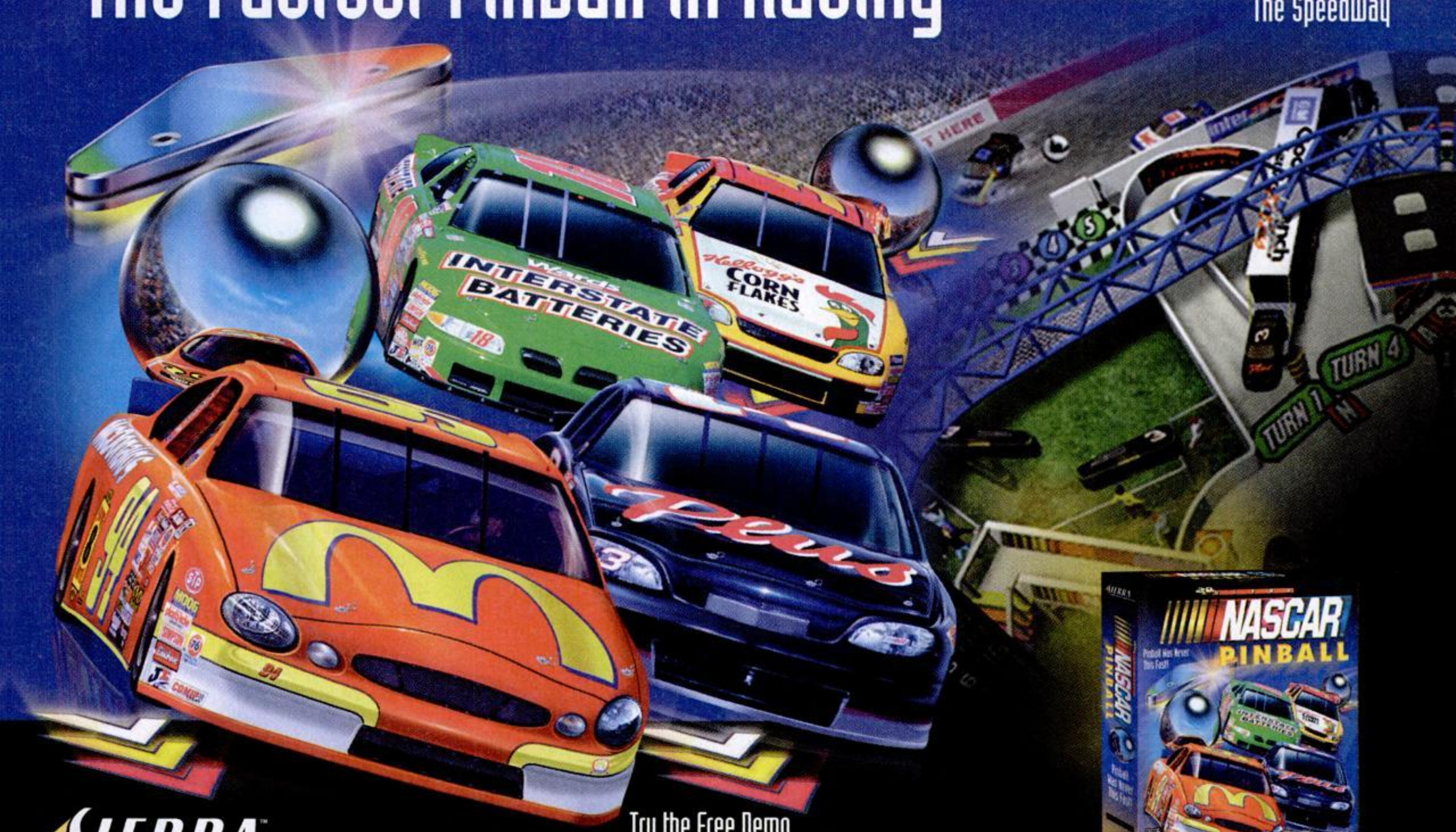
The Pit

Specialized tables simulate NASCAR® race strategy

The Garage

The Speedway

The Fastest Pinball in Racing



SIERRA attractions

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JDR Microdevices FirezEdge

A lean, mean gaming machine

Price is no object with the FirezEdge, but neither is reliability.

The FirezEdge is best likened to the Goliath American pickup-truck manufacturers: JDR's latest is big, tough, and clearly has the power under the good to take on any mountain (and it'll cost you). But while the FirezEdge probably won't explode in a side-impact collision, JDR's latest model might have to be sent back to the factory for other annoying glitches.

At its heart, the FirezEdge is a gaming machine designed by gamers. And the box comes stocked with the goodies gamers will wet themselves over: dual Diamond Voodoo² cards and a Matrox G200 2D/3D card (or the optional nVidia TNT-based Viper V550, not tested here). Other tasty morsels include a 10/100 Ethernet port and dual-channel Ultra Wide SCSI built into the motherboard, and a free Xeon slot for future dual-proc upgrades. Two of the four DIMM slots are also free, for pumping up RAM volume to a blistering 2GB.

As we saw with the first Xeon-based system we reviewed (Gateway's GX-450XL in the December 1998 issue), Intel's latest doesn't outperform the stock model by much. Compared to the vanilla 400MHz in Quantex's QP6 (reviewed in September 1998), the FirezEdge only managed to squeeze 8 more points out of the bootMark test for CPU/motherboard performance. And the Quantex had a faster hard drive (beating JDR's noisy monster by 1MB/sec) and a faster CD-ROM drive (coming in 4x better). JDR did manage to take the rest of our test suite, especially game performance, where it scored a retina-melting 116fps on *Forsaken* (58fps faster than the Quantex) and 83fps in *Quake II* (27fps faster than the Quantex).

But speed is nothing without control. During the SYSmark portion of our testing, which runs office and creative apps, the FirezEdge repeatedly hung during the Netscape portion. The "Fatal Set Hive 04" errors could not be corrected by swapping graphics cards, downloading the latest drivers, or reinstalling SYSmark. The folks at SYSmark are looking into a more detailed explanation, and we'll give it to you when we find out. We also had trouble with the *Inspire* test, but managed to work our way through and finish the benchmark.

One thing you'll never have to worry about with the FirezEdge is keeping your cool. JDR stacked the case with 14 fans and a digital thermometer. It's almost like they're begging you to overclock.

Other niceties include Cambridge Soundworks' 67-watt MicroWorks satellite-and-subwoofer setup, Thrustmaster's X-Fighter joystick (but the bundle is conspicuously absent a flight sim to use this with), and Iomega's ubiquitous Zip drive.

Overall, the FirezEdge will make roadkill out of most PCs shipping from today's corporate computer makers. The FirezEdge is a valiant effort and scored well on our gaming tests, but it needs more QA testing before leaving the factory. If we were potential buyers test-driving this system, we it wouldn't have driven it off the lot at this price.

—Rick Popko

PLUSES

- Dual-channel SCSI on motherboard
- Lots of fans
- Temperature gauge on the outside
- Awesome 3D game performance
- Free lifetime technical support
- 800 tech-support number
- 30-day money-back guarantee

MINUSES

- Failed SYSmark benchmark
- Didn't give us splash screen for Inspire
- Two ISA slots instead of PCI
- Strange hard drive noises

UNDER THE HOOD

THE BRAINS	
CPU	Intel 400MHz Pentium II Xeon
L2 Cache	512K CSRAM
RAM	256MB 100MHz SDRAM, upgradable to 2GB
Motherboard	Intel 440GX (dual slot/one free)
Drive Bays	Seven 5.25-inch (three free), two 3.5-inch (one free)
I/O ports	Two serial, one parallel, two com, two USB, joystick, S-Video, RCA, audio in/out
DISPLAY	
Video	Matrox Mystique G200 8MB, Two Diamond Monster 3D II 3Dfx cards with 12MB SGRAM per card
Monitor	Optiquest V95 19-inch, 18-inch viewable, .26mm dot pitch shadow-mask
Res/Refresh	1600x1200/75Hz at 24-bit color
STORAGE	
Hard Drive	Seagate 9.1GB 7,200RPM IDE Ultra DMA ST39140A
CD/DVE	Pioneer 36x with slot face
Removable	Teac floppy, Iomega ATAPI Zip
Fax/Modem	U.S. Robotics external 56Kbps V.90
Ethernet	Intel 10/100 Ethernet
SOUND	
Sound	Turtle Beach Montego A3Dxstream
Speakers	Cambridge SoundWorks MicroWorks

OTHERS

Onboard Adaptec 7895 dual-channel Ultra Wide SCSI | ThrustMaster X-Fighter Joystick | Microsoft IntelliMouse | PC Temperature Control Center

THE BUNDLE

Windows 98 | Quake II | MS Monster Truck Madness II | Activision BattleZone

BOOT 1:17 DOWN 0:03

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark		198
WINDOWS APPS SYSmark 98	official score	— failed to run
HARD DRIVE HD Tach	MB/sec	12.2
CD-ROM CD Tach98	drive rating	14.4
3D RENDERING Newtek Inspire3D	sec	533
DESKTOP PUBLISHING Adobe Photoshop 5.0	sec	78
DIRECT3D ForsakenMark	fps	116.3
OPENGL Quake2 v3.15	fps	83

MAXIMUM PC VERDICT

Price $4,999
Company JDR Microdevices
Phone 800.538.5000 x558
URL www.firezedge.com

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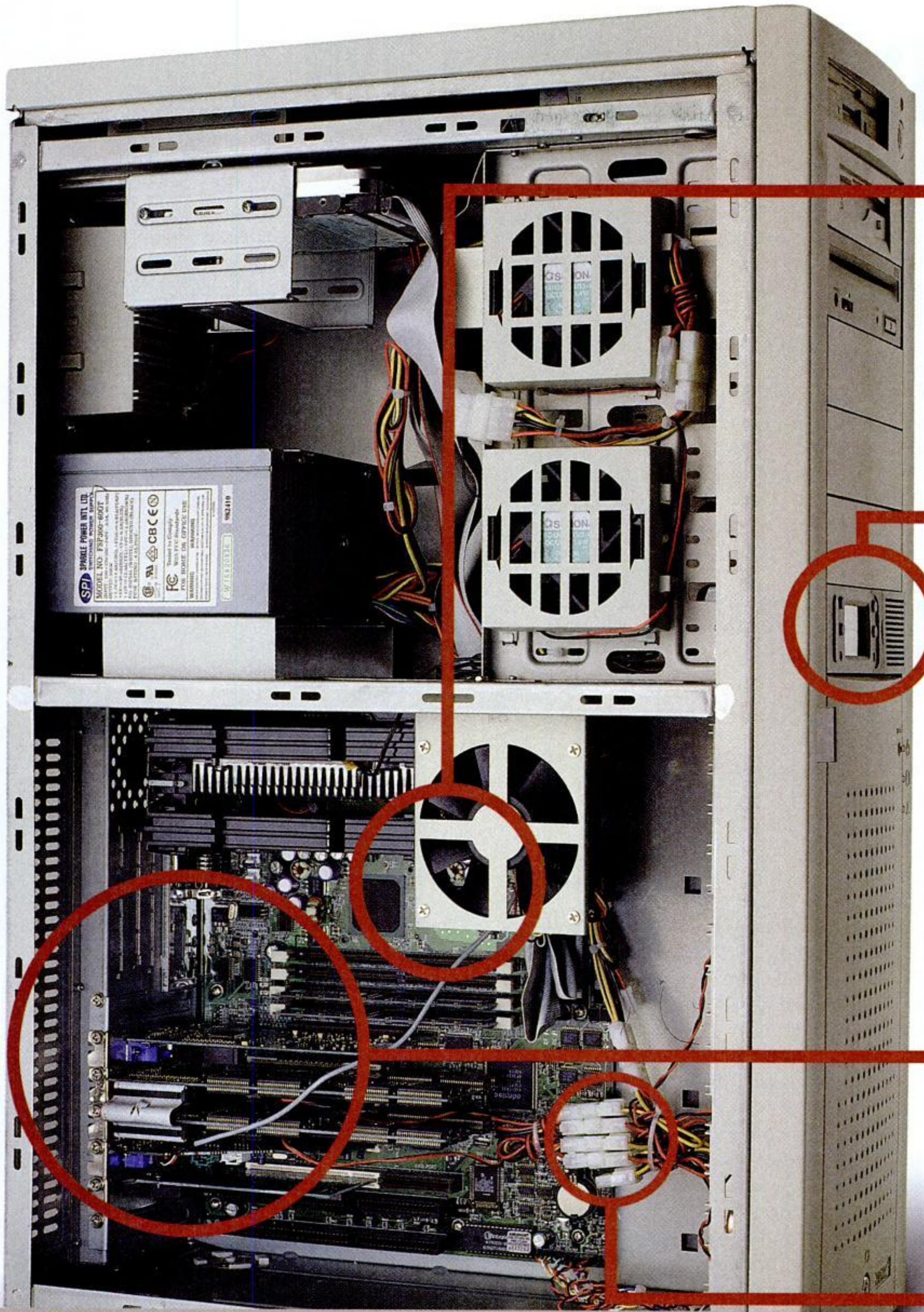
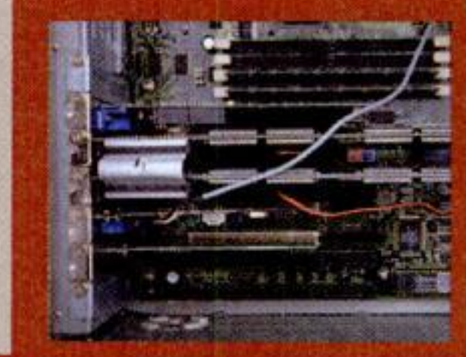


Is this cool or what? Not only does the P-II 400 Xeon have a honkin' metal heatsink, but as an added precaution, JDR put two fans on the processor.

Gauge in the Cage Because the developers of FirezEdge know that games run better when the chips are cooler, they paid close attention to heat issues in the machine. This internal box tells you how hot it is inside the machine at all times.



Gamers Delight You can have the FirezEdge configured with either a Diamond Viper550 using nVidia's TNT or Matrox's Mystique using its own G200 chip. Of course you also get two 3Dfx Voodoo² cards in there.

Fit to Be Tied The inside of the FirezEdge is as neat as an army private's freshly made bed. All wires and power cords are out of your way, so you can easily access everything inside the machine.

EXPANSION NOTES

This beastly tower's roomy when it comes to adding more drives. However, we couldn't for the life of us understand why the machine comes with two free ISA slots in lieu of free PCI slots.

EXPANSION MAP

AGP	2D/3D video
PCI	Voodoo²
PCI	Voodoo²
PCI	Audio
PCI	Ethernet
ISA	Free
ISA	Free

IROS

01 System timer	12 IRQ holder
02 Keyboard	13 TBS Montego
03 Interrupt controller	14 TBS Montego
04 COM 2	15 Mystique G200
05 COM 1	11 IRQ holder
06 Sound Blaster	12 Mouse
07 Floppy	13 Num data proc
08 Printer port	14 PCI bus master
09 CMOS	14 IDE controller
10 Ethernet 10/100	15 IDE controller
11 USB controller	15 IDE controller

DMAS

01 Sound Blaster	03 Printer
02 Floppy	04 DMA controller

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Third-Generation DVD

Mix and mis-match

The third-generation of hardware-based DVD kits has arrived, bringing multi-read capabilities and higher speeds, but unfortunately every one of the kits featured in this month's roundup has its own Achilles heel.

The most glaring shortcoming that will drag a DVD drive down is bad decoding. Sure, if you've got the MHz muscle, you could always opt for software decoding. But for those wanting to spare their CPU the burden (after all, someday software will come out on DVD that actually needs cycles), hardware decoding is the way to go and your decoder card can make or break any rig.

If we were to build our own kit today, we'd mix the Sigma REALmagic Hollywood+ decoder from Hi-Val's and Sony's offerings with the 5x DVD drive that Creative Labs is shipping. Unfortunately, no one has put this combo together... yet. And drive manufacturers are readying their next generation of drives (some at speeds faster than 5x).

DVD is the word this year, and more kits are on the radar. One of them is bound to get it right. As far as we're concerned, CD-ROM is dead: If you're going to drop your hard-earned cash on a new drive, make sure it reads DVDs.

—Sean Cleveland

Sony 5x DVD-ROM Upgrade Kit

THE SPECS

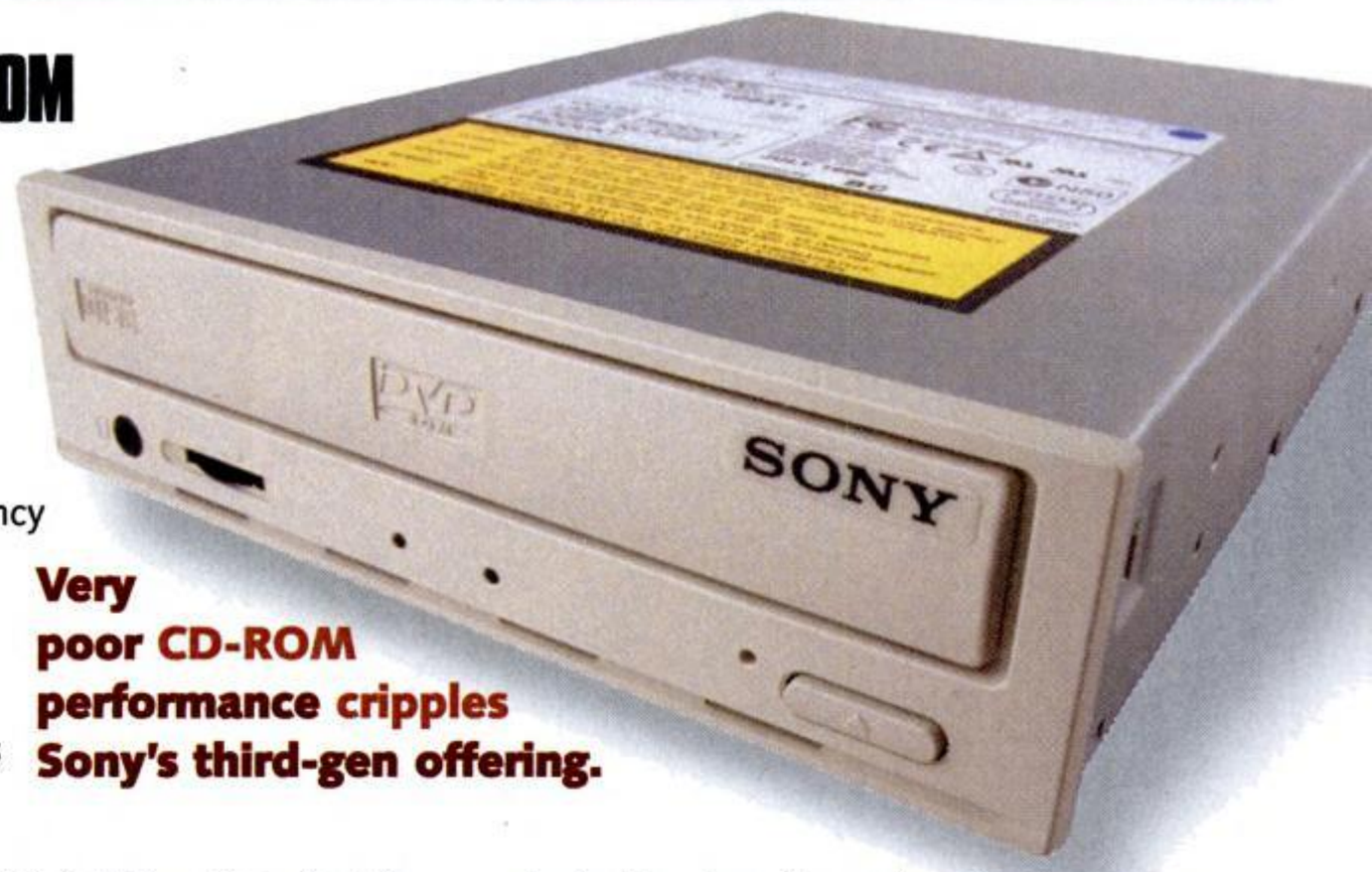
INTERNAL BUFFER
512K

REQUIREMENTS
Pentium 133MHz or higher
16MB of RAM
2MB of hard disk space
PCI 2.1 compliant slot

BUNDLE
Zork: Grand Inquisitor
Funk & Wagnalls Unabridged Encyclopedia

PLUSES
Excellent DVD decoder card
Excellent DVD-ROM drive performance
Excellent sound
Good bundle
Supports NT. 4.0

MINUSES
Weak CD-ROM drive performance
No frame advance



Very poor CD-ROM performance cripples Sony's third-gen offering.

With Sony's track record, it would seem to be a shoe-in for best-in-class consideration, but this kit is plagued with a major performance inconsistency that prevents us from recommending it without reservation. As a DVD drive, the DDU220E drive delivers its full spec'd speed, pumping data at upwards of 6.5MB/sec, it's full 5x rating. And it had no problems with the diet of varied DVDs we fed it.

Unfortunately the drive stumbles in CD-ROM performance, which wallowed in the 6x to 8x range on every testbed we used. We even tested several drives to confirm this, and all came up short of the 24x speed promised. Fortunately, Sony included the A3 version of Sigma's Hollywood+ decoder card for superb DVD playback (see review below).

And a hearty software bundle makes this the kit of choice if you already have a robust CD-ROM drive that you can't part with and are just looking to add DVD capabilities.

MAXIMUM PC VERDICT

Price $299
Company Sony
Phone 800.352.7669
URL www.ita.sel.sony.com

7

REALMAGIC HOLLYWOOD+

MAXIMUM PC KICK-ASS! product

Sigma Designs' newest MPEG-2 decoder delivers all the goods in a tight, sharp package. It uses a reverse pass-through cable that connects to the videocard externally for video overlay and offers TV-out by way of an S-Video connector. The card has both internal and external sound connectors for sound-card connectivity along with an additional external S/PDIF Dolby Digital (AC3) connector that carries six channels of digital audio to your digital amplifier.

Picture setting controls make brightness, gamma, contrast, and color-saturation adjustments a breeze by showing direct results, and calibration settings can be saved for all resolutions. Advanced controls include segment play, slow-motion play, and an image-capture utility that saves images to BMP files, although copyright restrictions prevent this feature from working with movies. And though it's scalable up to 1600x1200, the Hollywood+ delivers its sharpest picture at 800x600 (which is closest to the original film size).

Viewing movies via TV delivers a bright picture with rich colors, although graininess and a slight flickering cause eyestrain when viewing close-up. Lines are as sharp as they can be on a TV, but viewing on a computer monitor delivers a picture so

Copyrighted material

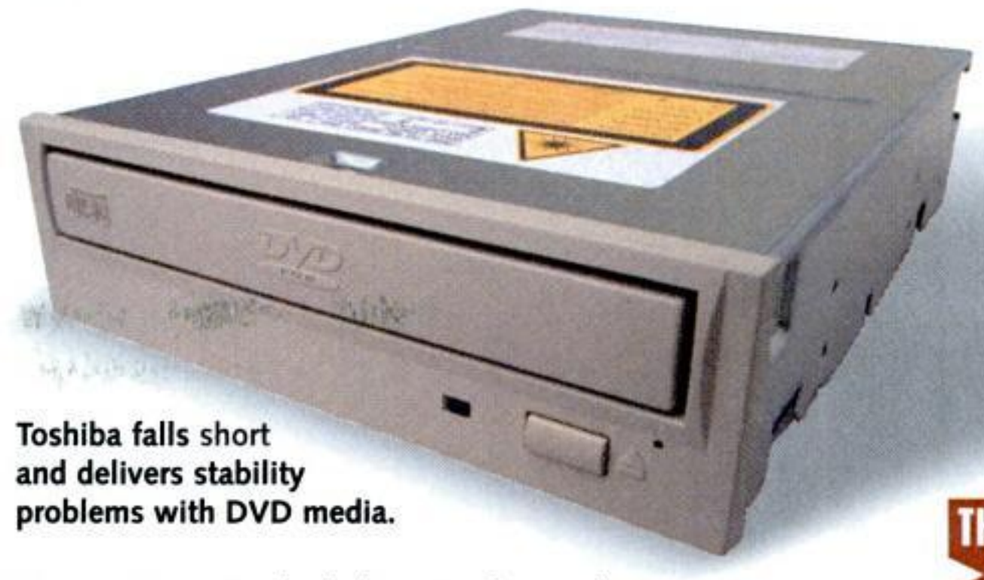
Hi-Val DVD-3 Kit

Bundling Toshiba's usually trustworthy drive with Sigma's Hollywood+, Hi-Val set out to create some serious data pumping, but the drive component in this pairing drags DVD performance down.

We tested several Toshiba drives, and all suffered problems reading data beyond the 4GB range on DVD discs, because the disc spins too fast and occasionally throws off the spindle. Data beyond the magic 4GB point makes the drive thrash, increasing CPU utilization and dragging down benchmarks. CD-ROM performance and stability was spot-on, though. Movie playback was initially spotty, but a firmware revision (v1020) fixed all problems.

And Hi-Val has the only kit we've seen that actually bundles a movie (the latest Bond flick *Tomorrow Never Dies*), and the version of Dragon's Lair included is arcade-quality.

Once Hi-Val upgrades Pioneer's new Ultra DMA 6x DVD drive later this year, they may have the kit to beat.



Toshiba falls short and delivers stability problems with DVD media.

MAXIMUM PC VERDICT

Price $249 ($349 with WaveCom)
Company Hi-Val
Phone 714.953.3000
URL www.hival.com

6

THE SPECS

INTERNAL BUFFER
256K
REQUIREMENTS
Pentium 133MHz or higher
16MB of RAM
2MB of hard disk
PCI 2.1 compliant slot
BUNDLE
Tomorrow Never Dies
Dragon's Lair DVD-ROM

PLUSES

- Excellent DVD decoder card
- Excellent CD-ROM drive peformance
- Excellent sound
- Great bundle
- Supports NT 4.0

MINUSES

- Terrible DVD-ROM drive performance
- No frame advance

DARE TO COMPARE

	SONY	TOSHIBA	CREATIVE LABS
Drive Type	DVD-ROM	DVD-ROM	DVD-ROM
Drive Model	DDU220E	SD-M1202	MK5002
Advertised DVD-ROM speed	5x	4.8x	5x
Advertised CD-ROM speed	24x	32x	32x
Interface	ATAPI	ATAPI	ATAPI
Drive architecture	CAV	CAV	CAV
DVD TACH BENCHMARKS*			
Drive rating (32K weighted average)	3.1x	2.6x	3.3x
Min. 32K sequential read (MB/sec / drive rating)	2.8 / 2.1x	1.4 / 1.1x	2.9 / 2.2x
Max. 32K sequential read (MB/sec / drive rating)	6.3 / 4.8x	5.9 / 4.5x	6.5 / 5.0x
Full-stroke access time (ms)	148	318	342
Random access time (ms)	83	141	87
DVD 1x CPU Utilization	12%	9%	10%
DVD 2x CPU Utilization	19%	100%	19%
DVD 4x CPU Utilization	52%	100%	100%
2K Interface burst speed (MB/sec)	4.1	5.4	2.5
8K Interface burst speed (MB/sec)	9.1	10.3	6.2
32K Interface burst speed (MB/sec)	13.3	13.4	9.0
CD TACH BENCHMARKS**			
Drive rating	6.7x	22.2x	21.3x
Min. 16K sequential read (MB/sec / drive rating)	0 .7 / 5x	2.2 / 15x	2.0 / 14x
Max. 16K sequential read (MB/sec / drive rating)	1.5 / 10x	4.8 / 33x	4.8 / 33x
Full-stroke access time (ms)	161	249	173
Random access time (ms)	100	83	82
4x CPU Utilization	1%	1%	1%
8x CPU Utilization	2%	2%	3%
12x CPU Utilization	Failed	4%	4%
32x CPU Utilization	Failed	6%	8%
2K Interface burst speed (MB/sec)	3.8	5.4	3.0
8K Interface burst speed (MB/sec)	8.3	9.6	6.9
16K Interface burst speed (MB/sec)	10.3	11.0	9.5
REDBOOK AUDIO EXTRACTION***			
CD Tach Extraction speed (drive rating)	10.2x	6.4x	9.9x

*Performs a full DVD-ROM benchmark assault. **Performs a full CD-ROM benchmark attack. ***Converts CD Audio to a WAV file.

sharp, you'll actually prefer to watch movies on your PC.

Pay close attention when buying this board. You may find one cheaper, but it may be based on the older A2 revision. The A3 revision that Hi-Val sells has better visual quality and can be differentiated by a yellow S/PDIF Dolby Digital (AC3) connector instead of an orange one.

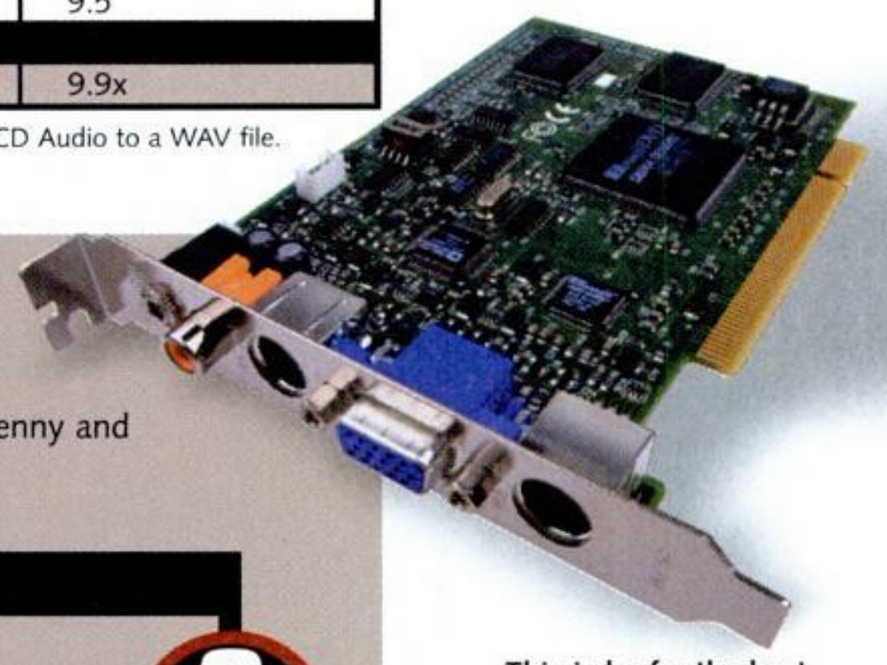
This board is worth every penny and you'll be happy to own it.

The player offers all the functionality that one would require except for frame advance.

MAXIMUM PC VERDICT

Price $120
Company Hi-Val
Phone 714.953.3000
URL www.hival.com

9



This is by far the best DVD decoder we've seen, and we can't recommend it highly enough.

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Creative Labs PC-DVD 5x Encore Kit

THE SPECS

INTERNAL BUFFER
512K

REQUIREMENTS
Pentium 100MHz or higher
16MB of RAM
6MB of hard disk space
Sound Blaster 16 or above soundcard

BUNDLE
Wing Commander IV DVD

PLUSES
Awesome DVD-ROM drive performance
Excellent movie controls
Excellent sound

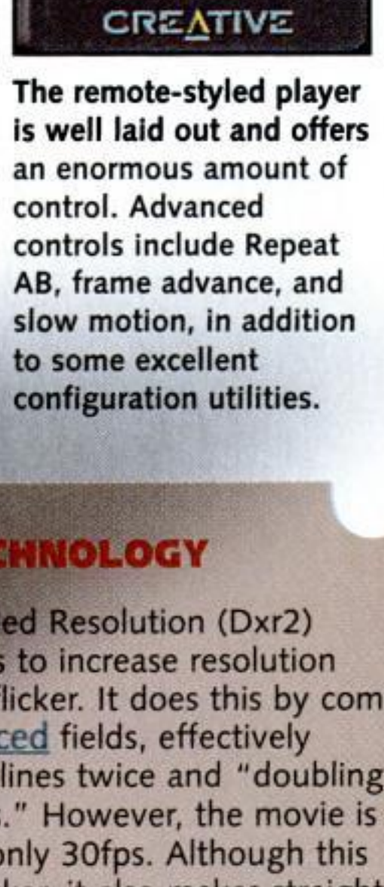
MINUSES
Poor-quality second-gen decoder
Old and wimpy bundle

The 5x Matsushita DVD drive in Creative Labs' new kit slapped down both Toshiba's and Sony's contenders in both speed and stability, but the included decoder card ties an anchor around the neck of this kit. C-Cube's card is last year's technology and can't compete with Sigma's Hollywood+.

This is unfortunate, since the awesome drive (made by Panasonic's parent company) performs exactly to spec. Benchmarks were rock-solid with both DVD and CD-ROM discs, and it had no problem with any disc we threw at it.

Unfortunately, the drive is only as good as the decoder, and movie playback suffers blotchy artifacts and aliasing jaggies on both computer monitors and TV screens. Also, a flat haze is apparent, especially on computer monitors. And when examined up close, splotchy patches of dithered color cascade in moving objects. Image blockiness is augmented by Dxr2 "line-doubling" technology, but this also reduces flickering.

Creative's PC-DVD is the best third-gen DVD drive available.



The remote-styled player is well laid out and offers an enormous amount of control. Advanced controls include Repeat AB, frame advance, and slow motion, in addition to some excellent configuration utilities.

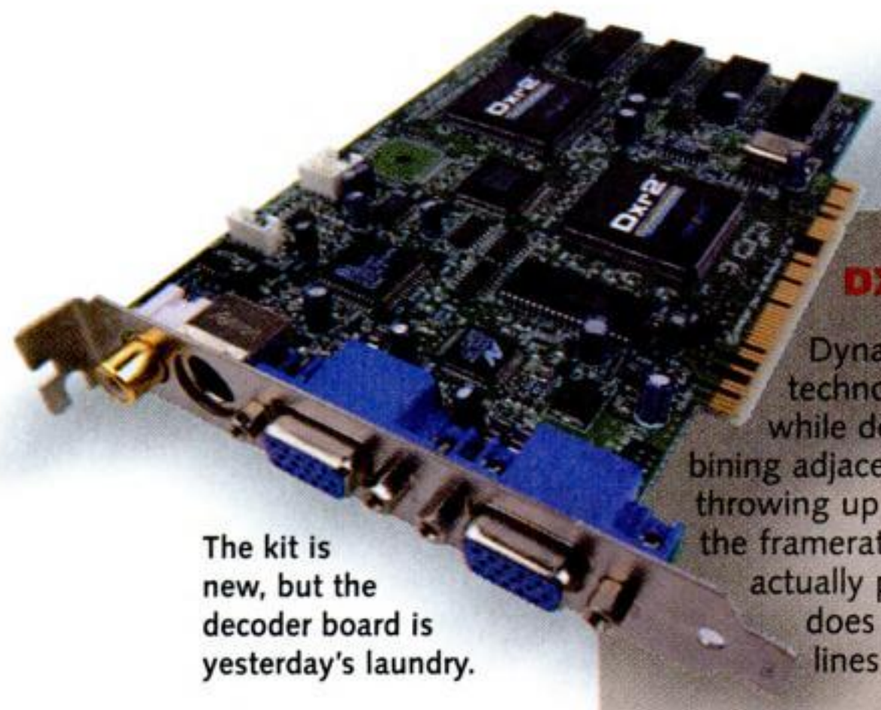
The card plays best at the recommended 800x600 resolution, with higher resolutions looking significantly worse. At 1152x864, images were so blocky we couldn't discern faces smaller than an inch wide.

Given that so many decoder cards are available, the drive may be the critical factor in a kit purchase, and you'd be hard-pressed to find one better than Matsushita's. When Creative Labs upgrades its bundled decoder card, we hope it goes with something as good as or better than Sigma's.

MAXIMUM PC VERDICT

Price $249
Company Creative Labs
Phone 800.998.5227
URL www.soundblaster.com

7



The kit is new, but the decoder board is yesterday's laundry.

DXR2 TECHNOLOGY

Dynamic Xtended Resolution (Dxr2) technology seeks to increase resolution while decreasing flicker. It does this by combining adjacent interlaced fields, effectively throwing up the same lines twice and "doubling the framerate to 60fps." However, the movie is actually played at only 30fps. Although this does reduce flicker, it also makes straight lines look more jagged and images look blocky. Dxr2 also detects and removes combing artifacts that cause shearing on moving objects on-screen.

While the technology is intended to improve movie viewing at resolutions up to 1280x1024, resolutions above 800x600 look increasingly worse with the effect. Also, movies don't play smoothly when played above 1024x768 as the card cannot keep up.

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Nihilistic is bringing the entire team to the GDC '99.

(They may have to take three cars.)

nihilistic software

L to R Back Row:

Yujin Kiem | Artist
Maarten Kraaijvanger | Lead Artist
Rick Servande | Artist
Steve Tietze | Director of World Design | Lead Level Designer
Rob Huebner VP | Director of Technology | Lead Programmer

L to R Front Row:

Brent McLeod | Level Designer
Steve Thoms | Level Designer
Ingar Shu | Sound Designer | Programmer
Ray Gresko | President | Producer | Designer | Programmer | Business Manager
Yves Borckmans | Programmer
Anthony Chiang | Technical Artist

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NHL 99

EA's powerplay brings home the cup

MAXIMUM PC KICK-ASS! product

Time to start that body checking with Electronic Arts' latest bad boy. *NHL 99* boasts the same bone-crunching rush as previous incarnations, but this time it's let loose in the rink with some marked improvements in AI, sound, and graphics.

The challenging AI pulls no punches. The limp reactions that marred previous NHL titles have disappeared, as computer-controlled opponents continuously hound you for the puck. The detail in *NHL 99* can sometimes be overwhelming, with everything from deteriorating ice conditions to player fatigue taken into account. But newbies need not worry about getting in over their heads, as *NHL 99* provides ample coaching drills from 1996 Stanley Cup–winning coach Marc Crawford. In addition to these drills, variable skill levels also ease unseasoned players into the rink.

THE SPECS

REQUIREMENTS
- Pentium 166MHz
- Windows 95
- 32MB RAM

VISUALS
- Direct3D
- Glide

SOUND
- Dolby Surround
- DirectSound

MULTIPLAYER
- IPX
- TCP/IP

PLUSES
- Awesome player animations
- Superb graphics and sound
- Merciless AI

MINUSES
- Polygon collision detection off
- Stiff camera angles
- Awkward multiplayer mode via Internet

Spot-on commentary provided by Daryl Reaugh and Jim Hughson is seamless with the flow of the game, with nary a transitional glitch. In addition, *NHL 99* makes full use of Dolby Surround Sound, ensuring you'll feel every pulp-pounding wallop from every direction. Atmospheric sound effects, including varied stadium organ themes, PA announcements, and the reverberated roar of the crowd, further complement the game.

Multiple shadows and the reflective surface of the ice show off NHL 99's visual bells and whistles.

Motion-captured players glide gracefully across the ice at accelerated resolutions up to a delicious 1280x1024. Players are composed of 1,200 polygons that are texture-mapped at resolutions up to 256x256. Unfortunately, this includes cheesy grins permanently plastered on the players' faces.

Motion-captured player animation adds a sense of authenticity to NHL 99.

Uh oh! The gloves are about to come off and the fisticuffs are about to begin.

Hockey fiends wait with bated breath for a good tussle to erupt, and *NHL 99* delivers the goods. When two players cross sticks, the fists start flying. There are separate controls to beat the snot out of the other player, including jabs and rabbit punches. Once the pugilism begins, be prepared for some hefty penalty-box time, and injured players. Derian Hatcher would be proud.

NHL 99 can link up to 12 players in an all-out slushy frenzy on up to eight computers for LAN play or only two computers for Internet play. Allowing players to choose a position and play with their pals against another team, *NHL 99* is sure to incite many virtual teams and competitions across the Internet. The two-computer maximum for Internet play is a bit under-ripe, but it's a step in the right direction.

And some feeble camera angles eschew your view of the puck. This, along with some shaky polygon collision detection and jittery slow-mo replays, reveals *NHL 99*'s ugly side. However, these trivial quibbles are merely minor chinks in the ice of an otherwise stellar game.

Whether you're a hockey fan or not, *NHL 99* is a dream come true and is sure to keep many a fan occupied until well after the Stanley cup finals are over.

—Dan Simpson

MAXIMUM PC VERDICT

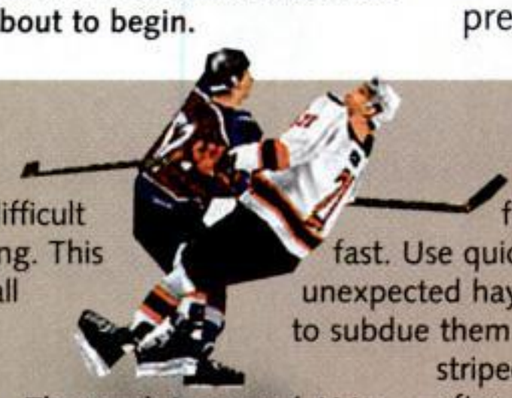
Price $45
Company Electronic Arts Sports
Phone 650.513.7555
URL www.easports.com

9

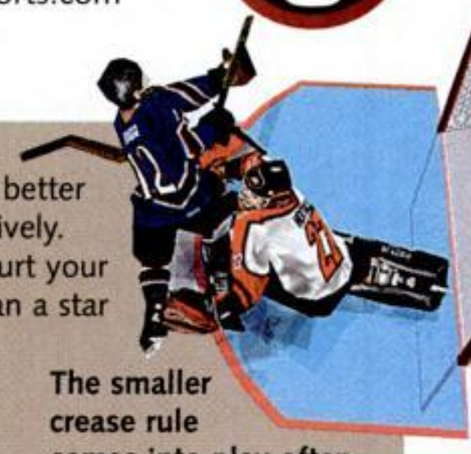
BODY CHECKING

Getting the other team to cough up the puck can be difficult without some gentle prodding. This is, after all, what hockey is all about, eh!

- Watch the rear checking. Nothing will get you sent to the penalty box quicker than a blow from behind.
- When you get into a fight, it's best to finish it fast. Use quick punches and an unexpected haymaker here and there to subdue them quickly. The man in the striped shirt will call it quits after a short period of time.
- Check the opposing team's stats before you begin. If they have a high rate of checking, sometimes it's better to play defensively. Nothing will hurt your team more than a star player who's out for the season due to an injury from haphazard checking.



The much improved AI is relentless on the attack. Be prepared to spend a fair amount of time practicing evasion and shooting.



The smaller crease rule comes into play often, and will have you crying for mercy.

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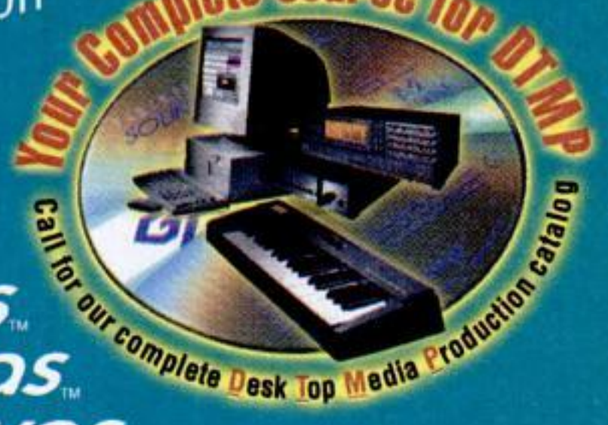

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Heart of Darkness

The horror! The horror!

Reanimating the lifeless corpse of 2D side-scrollers, Interplay, Tantrum, and Amazing Studios have crafted the would-be monster of the genre with *Heart of Darkness*. Replete with Saturday-morning-cartoon nostalgia and all things cute and cuddly, *Heart of Darkness* is for the light of heart and lame of wit.

You play Andy, a poor wee shaver whose dog was kidnapped by the shadowy forces of evil. In your quest to save the poor mutt, you must jump, shoot, and haphazardly guess your way from level to level. This luxuriantly fluid 2D world would make professional Hollywood animators green with envy and boasts smooth in-game animation. Too bad there's nothing to interest the average gamer.

Festering on this abhorrent carcass is an insulting 320x200 in-game resolution. All the painstakingly rendered environments are lost amid monstrous pixelation that precludes any sense of immersion or realism.

Evil is on the prowl in Heart of Darkness. Beware the ugly sprites!

THE SPECS

SUPPORTS
- DirectSound 3D
- DirectDraw
- Direct Input
- 320x200, 256 colors

PLUSES
- Smoothly animated sprites
- Good use of sound and music

MINUSES
- Boring and repetitive gameplay
- Horrendous graphics
- As if the world really needed another 2D side-scroller
- Inadequate screen resolution

Stumbling around in 8-bit color, *Heart of Darkness* pays homage to the late 1980s. Despite their ugliness, the in-game sprites are phenomenally fluid, with an amazing number of animations. Enemies cackle, whip about, and call their friends to assist in your demise. Andy is the highlight of *Heart of Darkness*, with more than 2,000 frames of animation just for walking in one direction. He jumps, shoots, and runs with detail and clarity. These remarkable animations manage to keep *Heart of Darkness* upright for a few lurching steps, but ultimately, this title is doomed to fall back into the grave.

The cut-scenes in *Heart of Darkness* are endlessly dull FMV clips that cling to this rotting corpse like a stinky cloud. Lame characters limp around a meager story and exist solely to fill in as cliché stereotypes. Despite the professional quality of the sound effects and character voices, the quick editing and exaggerated character movements are headache-inducing. On the plus side, the FMV segues well into gameplay.

Culled from the blasphemous crypt of mediocre games, *Heart of Darkness* further ails from thin gameplay that consists of little more than precise jumps and timed shots. The accompanying puzzles are irrelevant and unimaginative, and will have you pining for the good old days when thought was actually put into level design. Overly frequent deaths squelch any sense of enjoyment from this game, turning *Heart of Darkness* into a parody of better, long-dead titles. In the grand tradition of 2D side-scrollers, the variation between levels comes only in the differing environments, and what side-scroller worth its salt would be without an underwater level? *Heart of Darkness* is no exception.

Heart of Darkness is chock-full of weak FMV and hackneyed characters.

Extraordinary animations are a minor salve, and the only thing that exposes 90's technology in this game.

Professional-quality orchestrated music accompanies the game with a blazing force that only makes the rest of the game seem that much worse. Stellar sound effects make excellent use of ambient sounds and can be piped through 16 channels, but ultimately, it's too little, too late.

Underneath a lot of excessive hype and marketing hoopla, *Heart of Darkness* is a step backward in gaming evolution that will hopefully be soon forgotten.

—Dan Simpson

MAXIMUM PC VERDICT

Price $45
Company Interplay
Phone 949.553.6655
URL www.interplay.com

3

SIDE-SCROLLER FLASHBACK!

Anticipating the impatience of many would-be gamers, the developers of *Heart of Darkness* thought to include a little hint screen that pops up after you've died a certain number of times on the same hazard. Use these frequent deaths to your advantage. Sure it's annoying to hear Andy squeal like a pig every time he dies, but you have to suffer to get the beef from this game.

Be prepared to sit through many numerous and ponderous death scenes.

True to the cliché of its side-scroller predecessors, *Heart of Darkness* contains nary a level without a cheesy puzzle to be mastered before you can continue. To defeat the more obscure challenges, be sure to examine the area carefully. Can Andy scale up the side of the cliff? What happens if you jump on top of that glowing plant? The answers to some puzzles might be on a different screen as well, so be sure to check out the surrounding areas if you hit a roadblock. There is no scientific method to getting through *Heart of Darkness*. It's best to use the infinite lives to your advantage, as trial and error is the only real advantage here.

Unimaginative puzzles are the scourge of Heart of Darkness.

Ah, we love the smell of napalm in the morning...

For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpc.com.

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THE NEXT EVOLUTION

ALIENWARE

-PC Gamer, January 1998

PC GAMER EDITORS' CHOICE

"BOTTOM LINE: If you've got the money to spend, this is the gaming system to own."

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THE "HIVE-MIND"

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Abit BH6 1-AGP 5-PCI 2-ISA Slots
Intel 440BX Motherboard 512K Cache
Expandable to 384MB SDRAM
PC Power Cooling K-1 CPU Fan
128MB SDRAM (PC-100)
1.44MB 3.5" Floppy Drive
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Canopus Pure 3D Voodoo2 12MB
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SoundBlaster LIVE! 3D Sound
Cambridge 4-Point Surround
Speaker/Subwoofer System
Toshiba 32X CD-ROM Player
ATX Full-Tower Case 300 Watt PS
KoolMaxx Video Cooling System
104-Enhanced Keyboard
Microsoft Intellimouse PS/2
US Robotics 56K V.90 Fax/Modem
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of Favorite Games/Latest Drivers

PRICE: $2,499.00

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Abit BH6 1-AGP 5-PCI 2-ISA Slots
Intel 440BX Motherboard 512K Cache
Expandable to 384MB SDRAM
PC Power Cooling K-1 CPU Fan
128MB SDRAM (PC-100)
1.44MB 3.5" Floppy Drive
Canopus SPECTRA 2500 TNT 16MB
Canopus Pure 3D Voodoo2 24MB
SLI-Mode Witchdoctor TV-OUT
H3D Stereoscopic VR Glasses
14.4GB IBM Deskstar HD (7200RPM)
Iomega Internal ZIP Drive 100MB
SoundBlaster LIVE! 3D Sound
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ATX Full-Tower Case 300 Watt PS
KoolMaxx Video Cooling System
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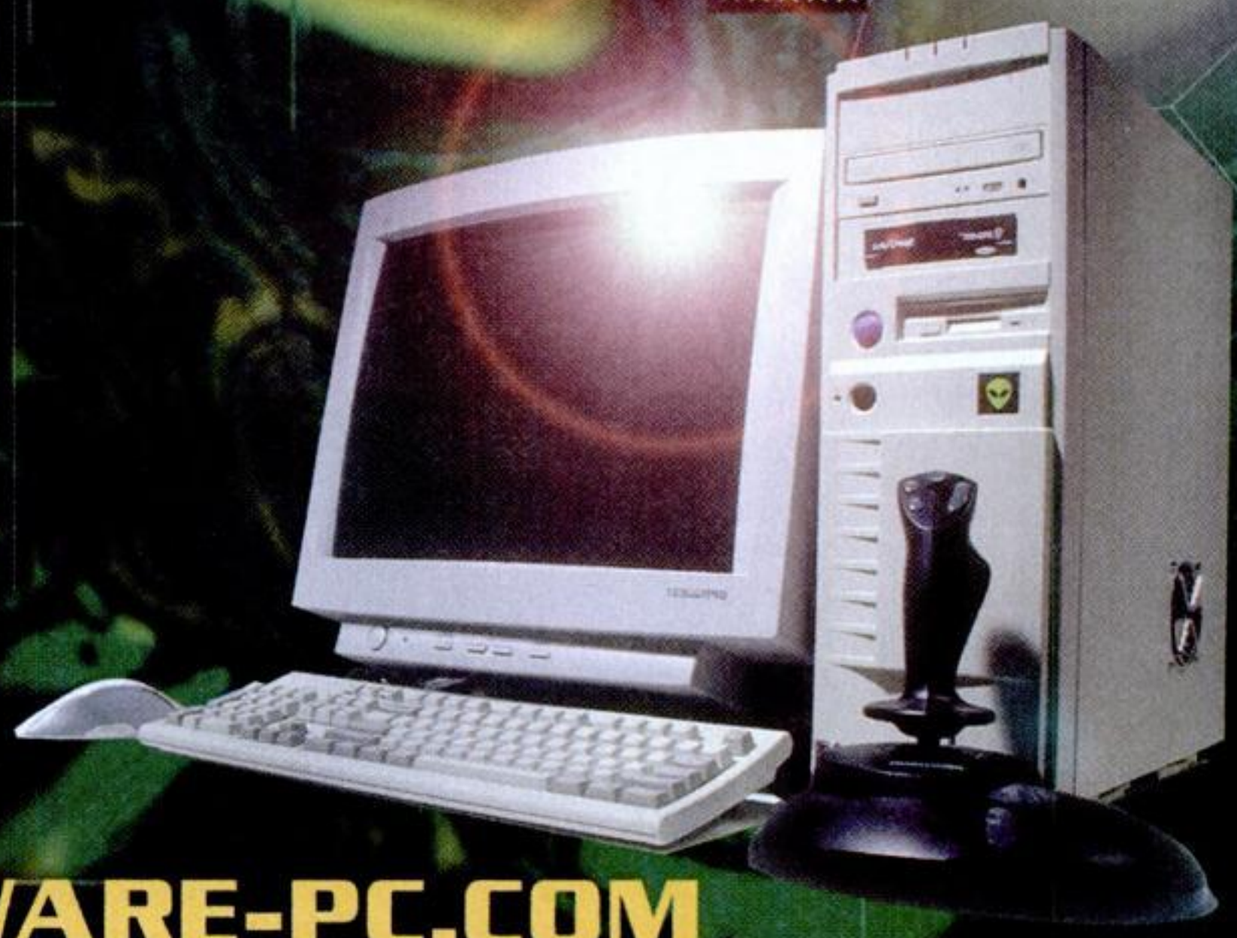

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Biography ▶

Phil Lacefield Jr. helped open the only Internet café in his hometown of Dayton, Ohio. He also runs a busy used computer store and a local ISP, co-hosts a call-in radio show on computers, and helps create sci-fi board games. Phil's been gaming since the VIC-20 and would really like to have a serial port permanently installed in the back of his head in order to communicate directly with his beloved Palm Pilot.

Dan Simpson lives in sunny California, biding his time in Santa Cruz as a technical writer in the dungeons of a big UNIX company. With clay tablets, a hammer, and a chisel, he carves out documentation, release notes, and other sundry items few people read. He's owned and fried more than his fair share of hardware, but reminisces mostly about his beloved Commodore 64. His current addictions include Starcraft, the-force.net, and making silly web pages. When not in front of a computer, he listens to strange music and watches bad movies.

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Two lucky winners will receive the Multiscan F500, Sony's flagship model, introduces the very latest in advanced CRT display technology from Sony: the unique FD Trinitron CRT. Selected as the computer display of choice for Maximum PC's "Dream Machine", this virtually flat CRT minimizes geometric distortion and reduces reflective glare that may cause eyestrain. Designed with the demanding CAD and graphic professionals in mind, the Multiscan F500 redefines image performance, ease of use and reliability. This Christmas, seeing is believing, so make sure you check out Sony's GDM-F500! Three winners will take home the Sony GDM-400PS computer display incorporating the legendary Trinitron technology, now with a new flatten CRT and Sony's Enhanced Eliptical Correction System technology designed to enhance image performance.

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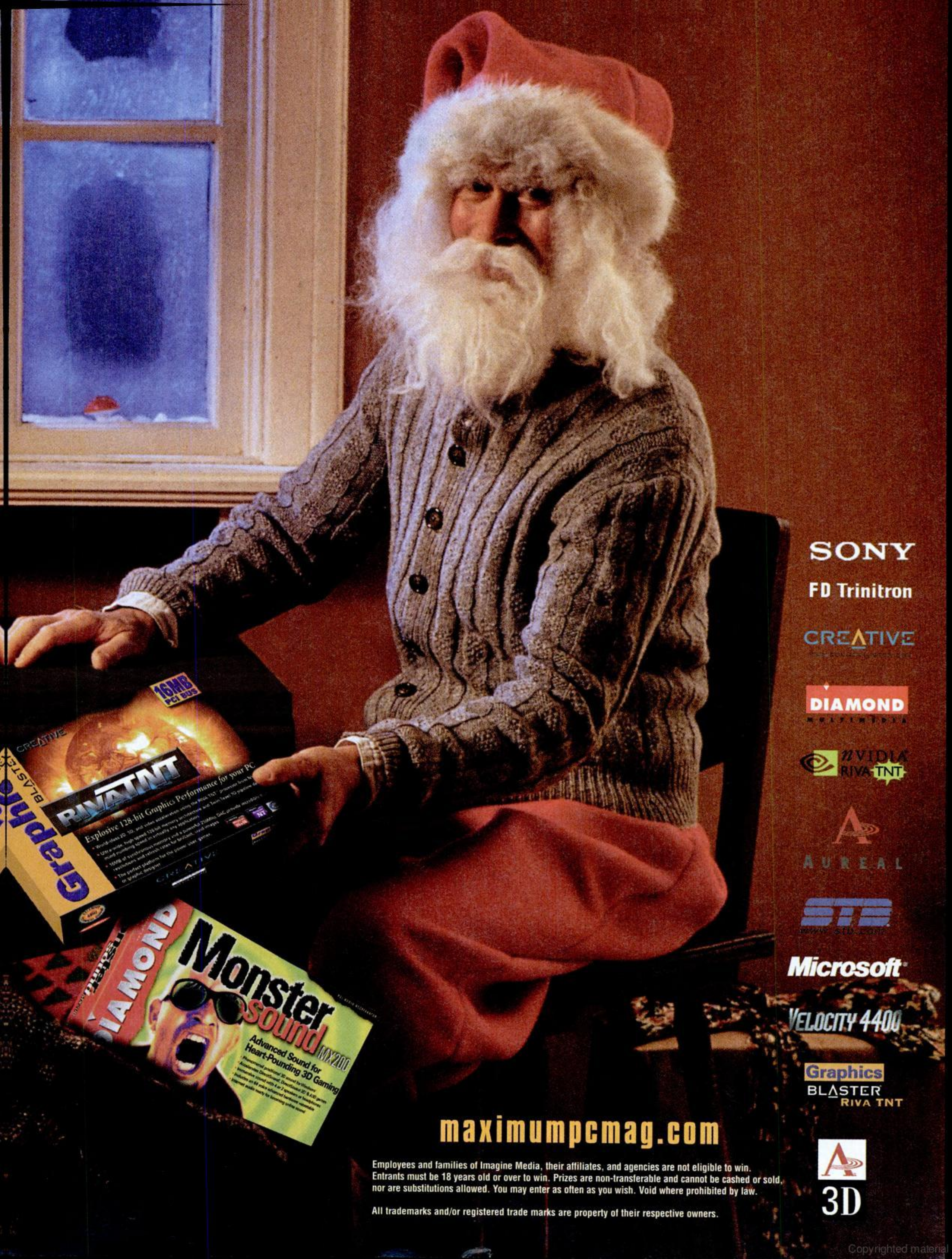

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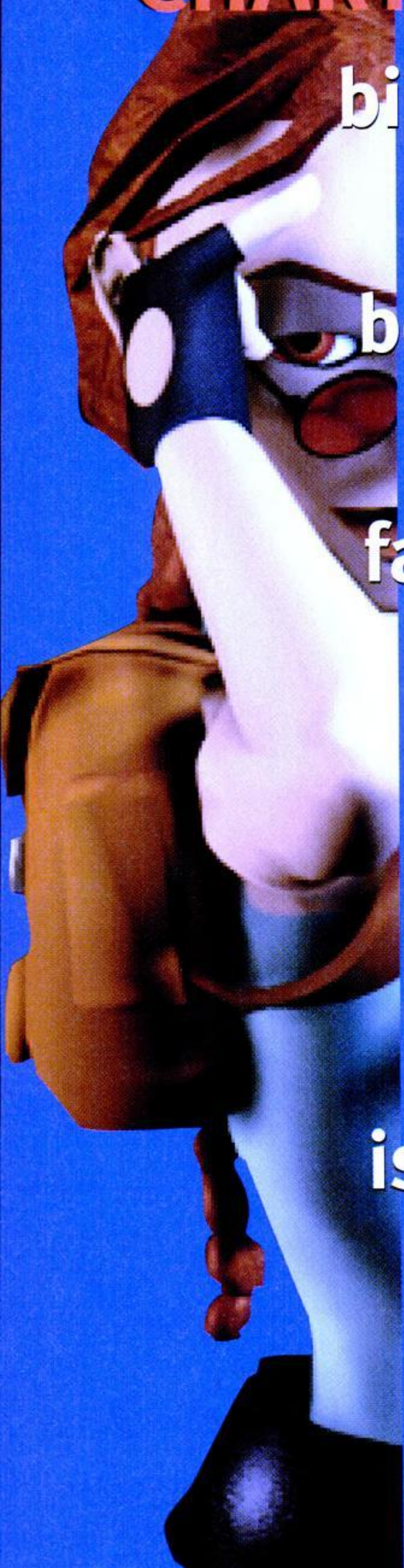

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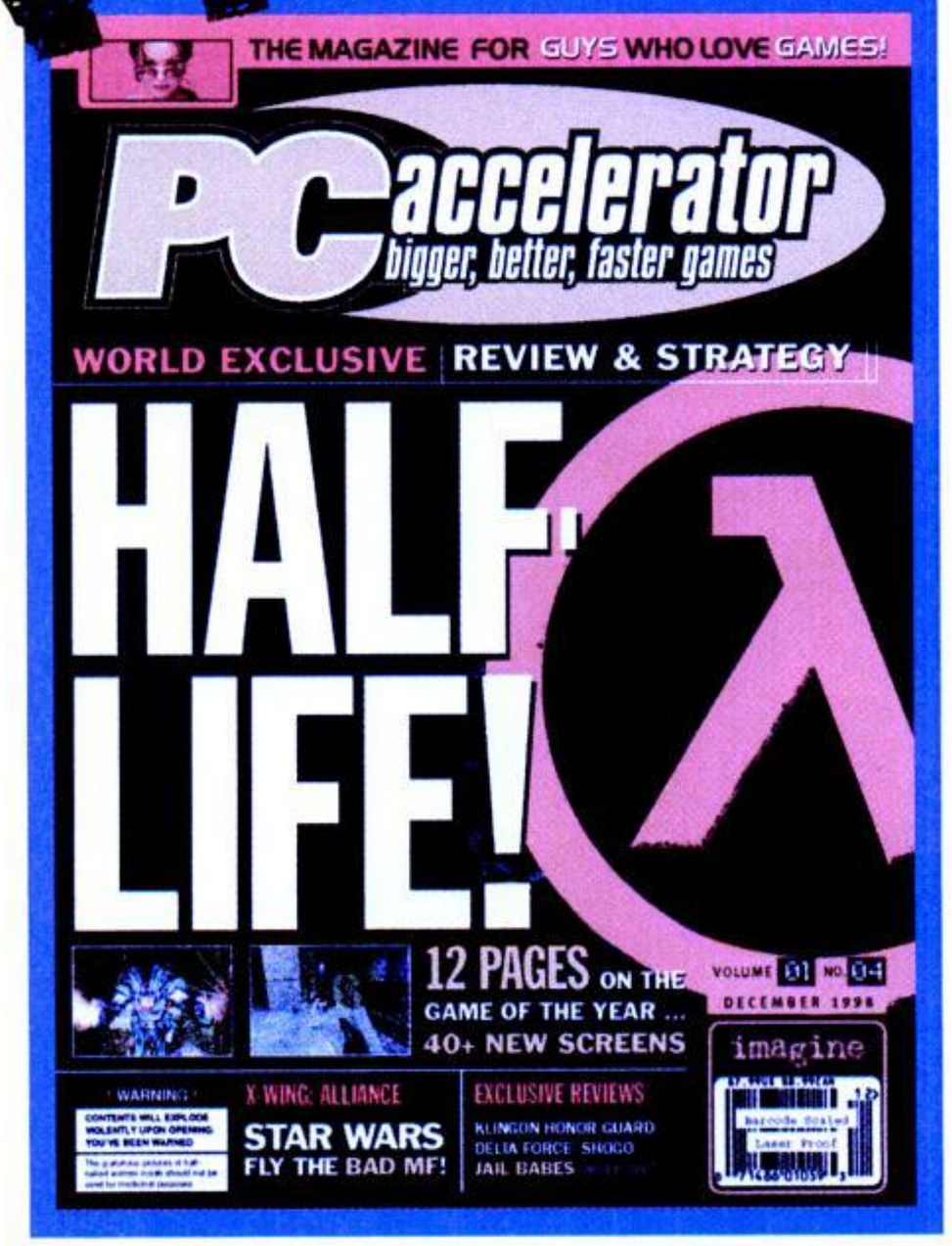

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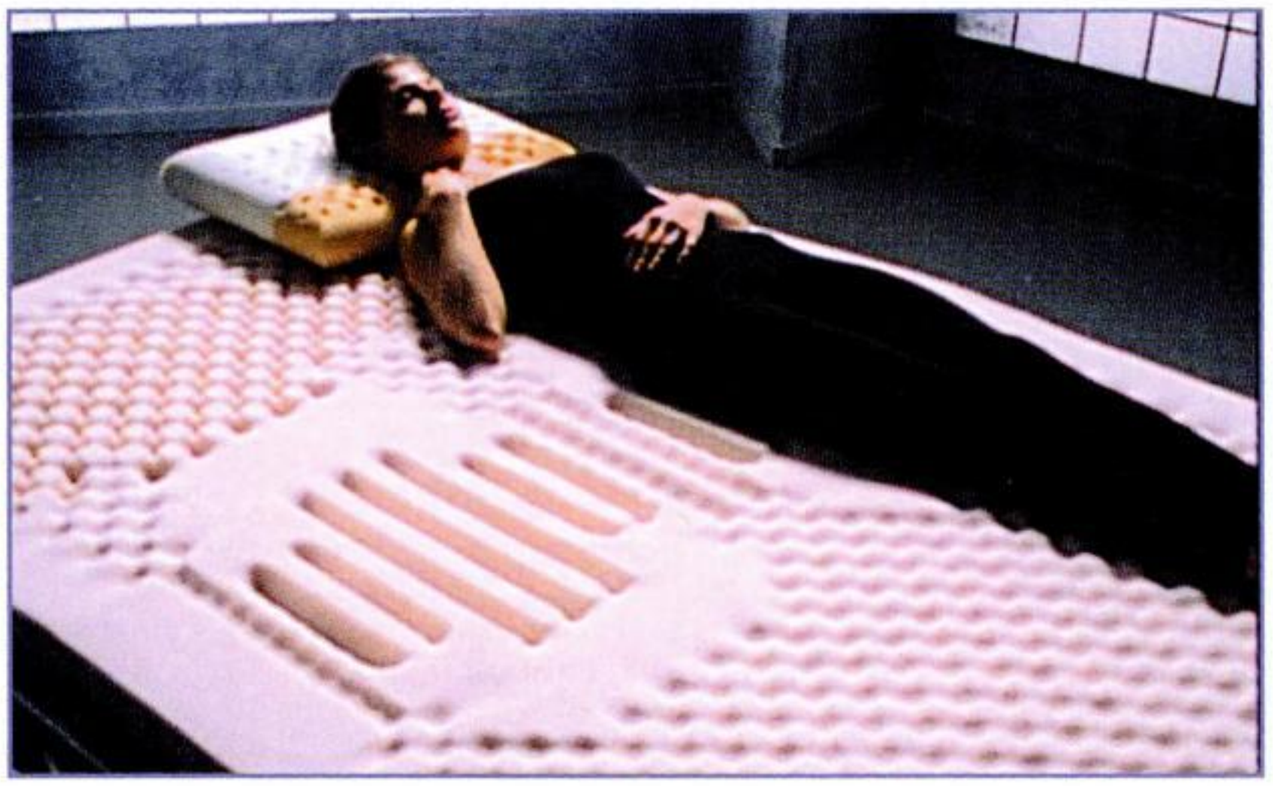

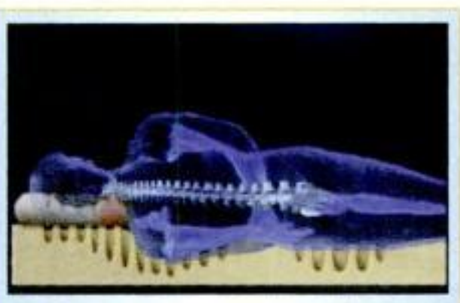

The distinct comfort zones in NatureSleep Platinum have revolutionized the sleep-product industry. They reduce sleep stress—especially strain on the spine—and cradle those areas of the body prone to increased pressure.

by Christine Wolf

I lead a hectic life. Between my part-time job, the kids, after-school activities and sports, my days are filled with things to do, places to go and people to see. This non-stop activity from dawn until dusk can be fulfilling, but it can also be pretty stressful, so at night, I need to relax and recuperate. Nothing helps me rebound like a good night's sleep, and nothing helps to promote restful therapeutic sleep like the proper mattress.

Tossing and turning. Unfortunately, mattresses can range in price from $150 to more than $2,000. Plus, even some expensive mattresses fail to support your body evenly. Traditional mattresses provide a flat sleep surface, supporting your body at the shoulders, the hips and the heels. This leaves your lower back and legs unsupported and hinders proper circulation. Even expensive waterbeds, which are supposed to distribute weight evenly, fail to support the body properly. Your spine arches downward, in a position specialists refer to as "hammocking," causing excessive strain on the back. Scientists and doctors agree that the ideal position is a neutral body posture in which the different parts of the human body are supported individually and evenly. This is the secret behind NatureSleep Platinum, the revolutionary product that turns any bed into the ideal sleep surface.

Scientists and doctors agree that the ideal position is a neutral body posture in which the different parts of the human body are supported individually and evenly. This is the secret behind NatureSleep Platinum, the revolutionary new product that turns any bed into the ideal sleep surface.

Scientific solution. Anatomic Concepts, a medical products research and manufacturing company, has designed a patented and anatomically-correct mattress pad. Using research originally conducted for hospitals, this innovative company developed an effective, affordable way to transform any mattress into a specially-designed sleep surface that closely matches the shape of the human body. It features a patented five-zone sleep surface that holds the body in a neutral posture and redistributes pressure during sleep.

Comfort zones. The distinct comfort zones in NatureSleep Platinum have revolutionized the sleep-product industry. They reduce sleep stress—especially strain on the spine—and cradle those areas of the body prone to increased pressure. The first zone supports your upper neck and head, and is so effective that you may find yourself using thinner pillows. The second zone allows your shoulders to "sink" to a comfortable level, while the third zone supports your lower back. Your hips and buttocks have room to relax with little or no pressure in the fourth zone, and the fifth raises your upper legs to keep your spine in the neutral position. This patented system results in a supportive, super-comfortable sleeping surface that promotes more restful sleep. Until now, only the most expensive and most advanced mattress products featured this degree of technology, but now you can get it without even buying a new mattress.

Installs in seconds. NatureSleep Platinum fits right over your existing mattress, uses normal sheets and turns any bed into an anatomically-correct and incredibly comfortable sleep surface. The five comfort zones have been created using a computer-designed grid pattern and are engineered to accommodate people of all heights and sizes.

Risk-free. Don't you owe it to yourself to get a restful, therapeutic night's sleep? After one week of sleeping on a NatureSleep Platinum, you'll wonder how you could have tortured yourself all of those years by sleeping on a hard, flat surface. You'll never go back again! Best of all, you can try NatureSleep Platinum on your own bed, risk-free. It comes with a one-year manufacturer's limited warranty and Comtrad's exclusive risk-free home trial. Try it, and if for any reason you are not completely satisfied, return your purchase within 90 days for a full refund, "No Questions Asked."

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TECHNOLOGY UPDATE

Big sound from a stereo radio—without the big price!

Zenith Audio, a leading electronics manufacturer designs a "Small Footprint", "Big Sound" stereo system and drives the price below $100.

by John Jameson

I leaned back slowly in my chair with my eyes closed, listening to the haunting melody of a Mozart symphony. The acoustics were flawless, and the room was soon filled with full, rich stereo sound. From the crisp highs of the flutes to the tooth-rattling bass of the kettle drums, the music was crystal-clear and powerful. I could distinguish the distinct sounds from each individual musician, and as the orchestra reached the finale I almost fell out of my seat from the awesome force of the music. As the music faded, I leaned forward and hit a button on the stereo clock radio. I had a concert to go to that night—it was time to check the weather.

Ultimate sound machine. Zenith Audio has developed a Digital Stereo Clock Radio that boasts the acoustic quality and practical features of stereo radios four times as expensive. You'll be amazed at the sound quality and powerful bass you get from a radio this small and this affordable. This stereo radio features an 11-key handheld remote control and an input jack for CD players or other audio sources.

The best bass. Many small stereo radios can sound tiny and weak. This unit has an exclusive EXB button for expanded bass performance. It intensifies the lower tones for CD or FM stations, giving you rich, full and powerful stereo sound. If you want to listen to the stereo in private, there is a headphone jack on the side of the unit.

Loaded with features. You won't find a tabletop stereo with more added options. The AM/FM radio features digital tuning for pinpoint reception and crystal-clear sound. The STEREO indicator allows you to tune in to the stereo signal. It also picks up **TV** and **WEATHER** signals with 13 TV channels and 7 Weather channels, so your Zenith Audio Clock Radio is a great source of news, entertainment and information. You can program the unit's memory for 37 preset stations, and the tuning buttons can operate either manually or in a automatic search mode.

Practical functions. The backlit clock has several alarm functions, so you can wake to either radio, TV, Weather or a buzzer. The sleep timer allows you to fall asleep to up to 90 minutes of music, TV or weather and then shuts off automatically. In the morning, if you need a few extra minutes of sleep, press the SNOOZE bar on the control panel or on the remote. The radio or alarm tone stops for 10 minutes and then sounds again. The process can be repeated several times as required. The unit's battery backup system will maintain the time, alarm and preset station memories in the event of a temporary power interruption. There is even a low battery indicator so you'll never oversleep in the event of a power failure.

Factory direct risk-free offer. You can spend hundreds of dollars more on a stereo radio, but why do it? We get the Stereo Clock Radio direct from Zenith Audio and pass the savings on to you. This product comes with a one-year manufacturer's limited warranty and Comtrad's exclusive risk-free home trial. If you are not satisfied for any reason, simply return it within 90 days for a full "No Questions Asked" refund.

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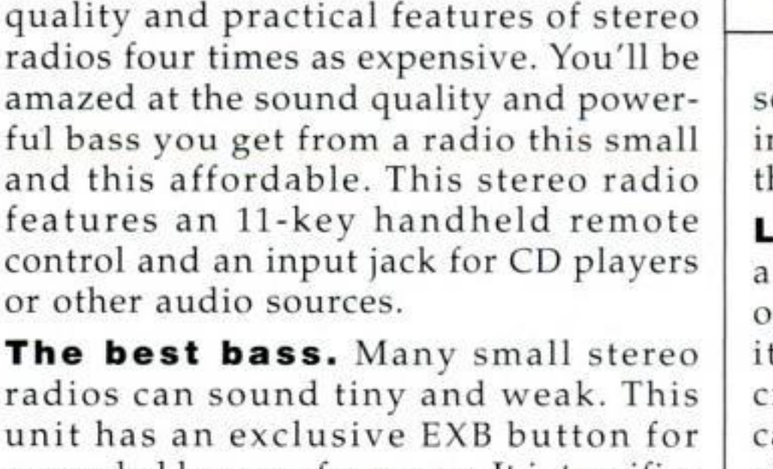
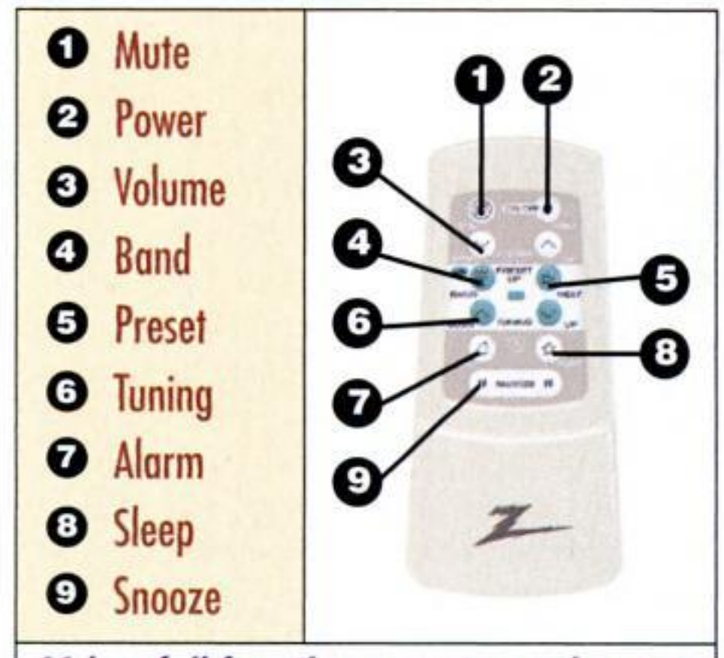


The Zenith Audio Clock Radio has an exclusive EXB button for expanded bass performance. It intensifies the lower tones for CD or FM stations, giving you rich, full and powerful stereo sound.



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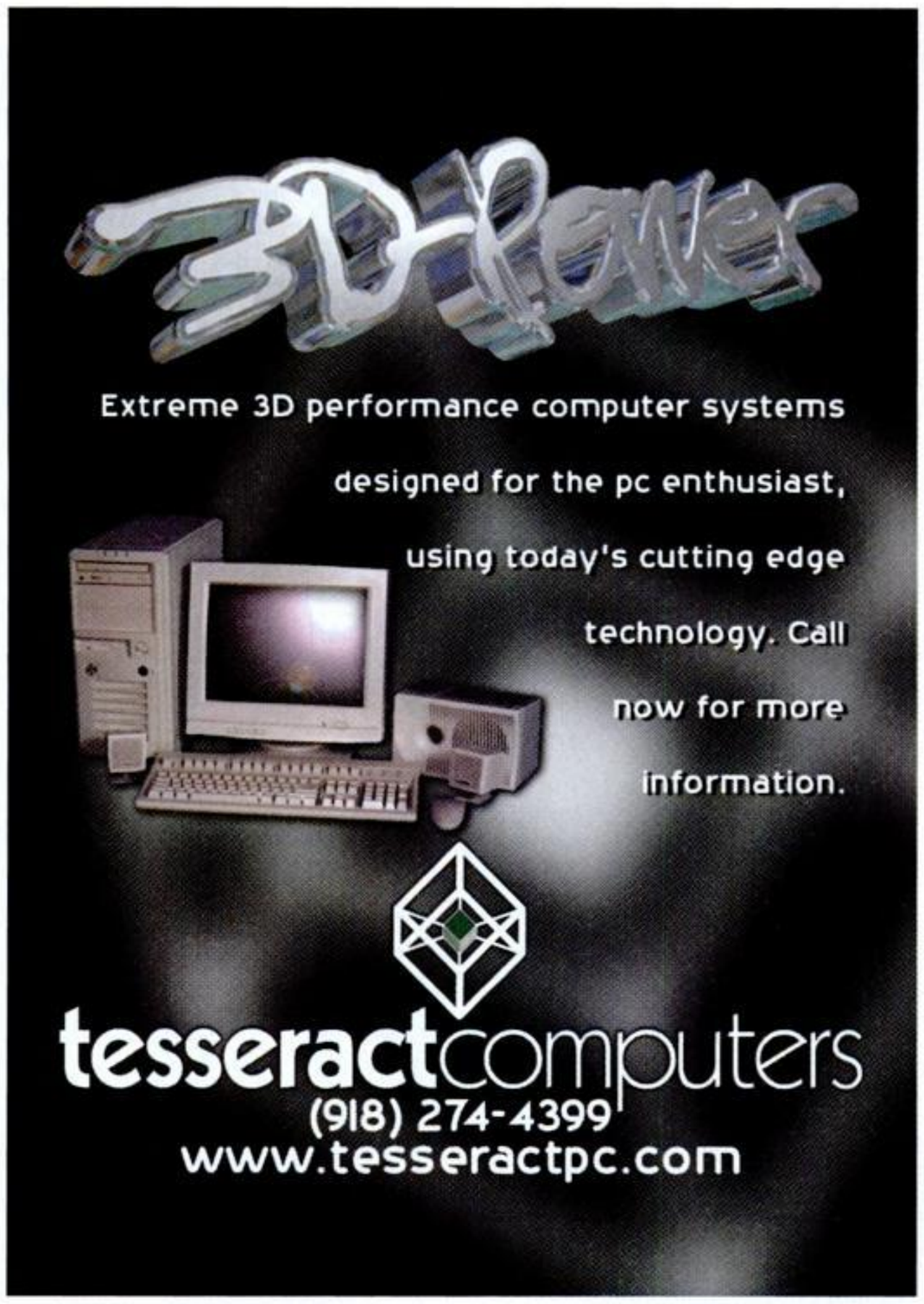

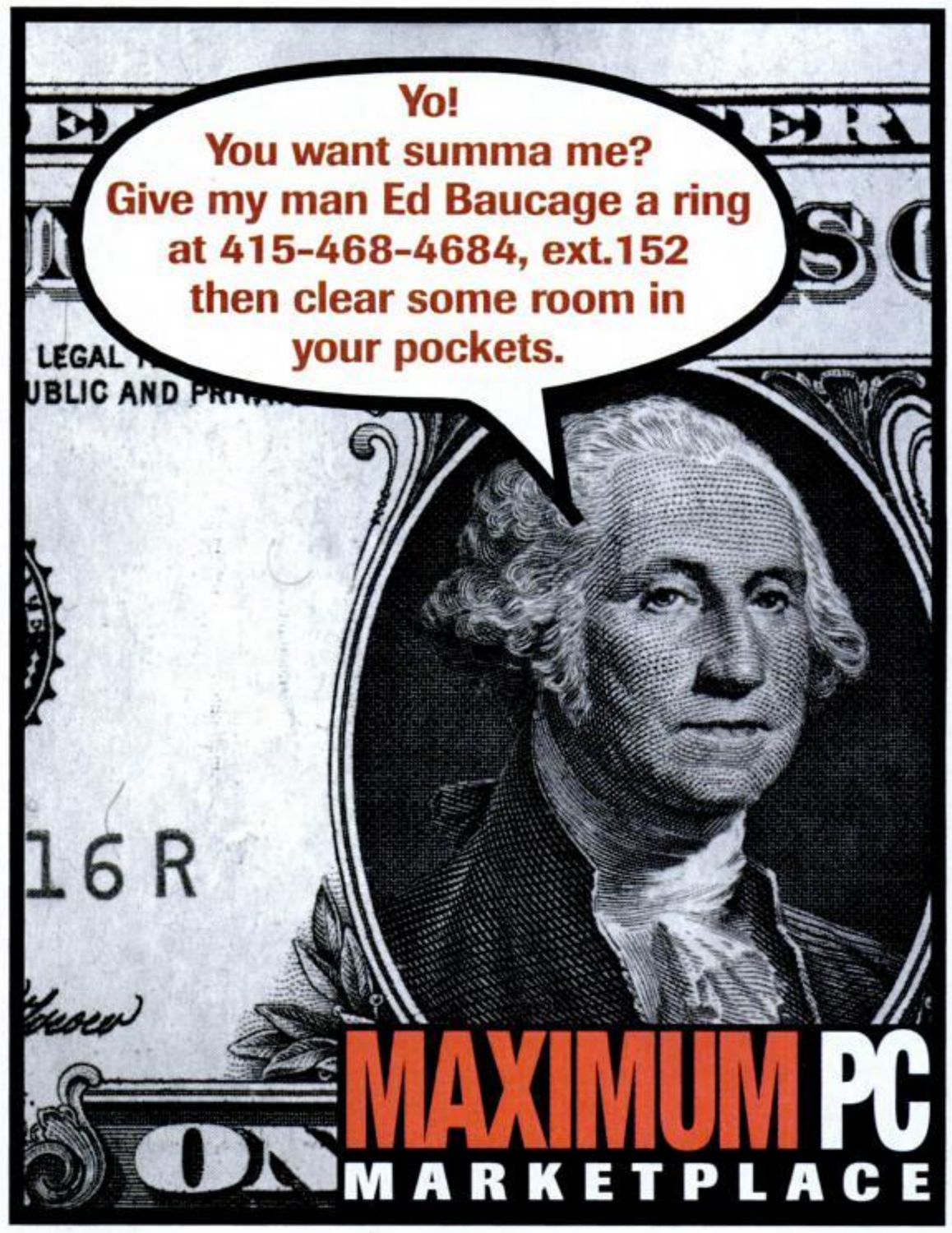

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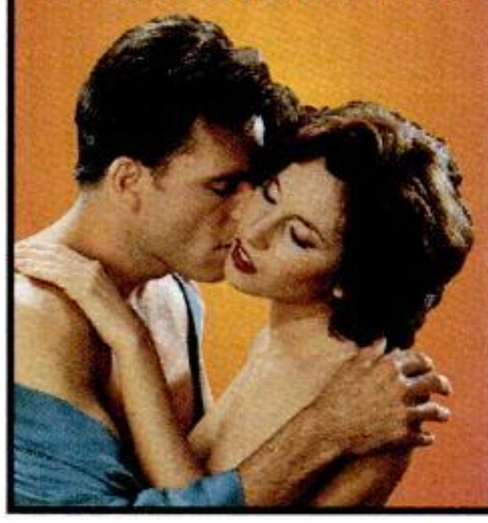

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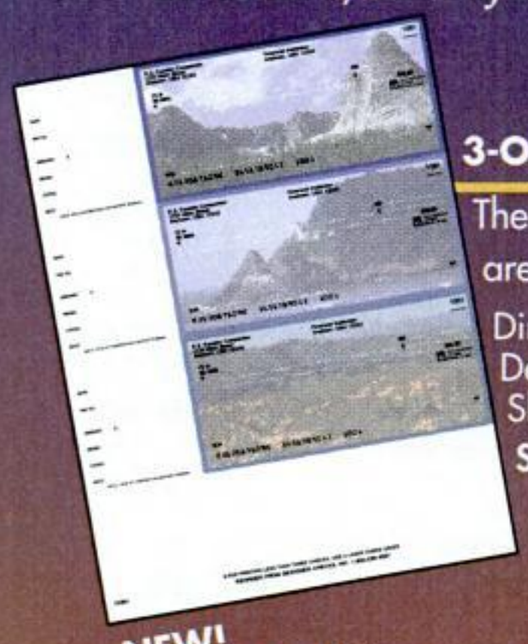

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Tech Terms Revealed ▶

Technical terms found throughout MAXIMUM PC are underlined and in blue. Hyperlink back to here for revelation and further explanation. Terms appearing in **blue** within the Terminator are updated definitions of previously explained concepts. The extended Terminator (with terms not found in this issue of the magazine) is also found online at **www.maximumpc.com**.

A

A/B comparison The process of comparing two products, performance, or features against one another.

AI Artificial Intelligence. A way for game developers to simulate thought processes of sentient life. Artificial intelligence can range from simple movement and attack patterns to simulated lives, complete with eating, movement, and action/reaction modes.

alpha-blending A technique that allows 3D objects to appear solid, invisible, or translucent, depending on their relationship with other parts of a scene. It's often used in games to depict special effects, such as explosions and weapon discharges, as well as semi-transparent objects, such as water and glass.

anisotropic filtering A technique that improves the appearance of textures mapped onto 3D objects. Without it, textures may appear unnaturally elongated on curved surfaces. Anisotropic filtering compensates by modifying the textures when projecting them onto the surface.

anti-aliasing A technique that smooths the edges of diagonal lines on the screen. Without anti-aliasing, diagonal lines often have a "jaggy" appearance caused by the stair-step effect of the pixels. Anti-aliasing blurs the edges of the lines. In 3D graphics, bilinear and trilinear filtering provides anti-aliasing for textures.

ASP server Active Server Pages. A Microsoft standard for building web based applications. ASP files can combine HTML scripting—such as JavaScript, VBScript, and components written in any language.

aspect ratio The relation between a display area's width and height. For example, in a traditional 4:3 aspect ratio, the display is defined by four horizontal-length units for every three vertical-length units. In a 16:10 aspect ratio, the width is elongated for a much more pronounced rectangle. It's important to note that typical monitor resolutions—640x480 through 1600x1200—all employ a 4:3 aspect ratio.

B

backside bus The interface that connects a microprocessor to Level 2 (L2) cache. No other system devices share the backside bus. This contrasts with the frontside bus, or system I/O (input/output) bus, which many devices typically share. A backside bus helps eliminate performance bottlenecks.

bandwidth The amount of data that can be transmitted in a fixed amount of time. Bigger is better. For digital devices, the bandwidth is expressed in bits per second (bps) or bytes per second. For analog devices, the bandwidth is expressed in cycles per second, or Hertz (Hz).

bilinear filtering A method to make textures appear less pixelated. The process involves the creation of a final filtered pixel by interpolating and averaging the values of four texels. This interpolation is done with the red, green, blue, and alpha value of each pixel.

BIOS Basic Input/Output System. A low-level part of the operating system found in IBM PC-compatible computers that contains your computer's most rudimentary instructions on how the operating system communicates with hardware. Unlike the rest of the operating system, it's stored in ROM or Flash ROM chips on the motherboard instead of on the hard disk, to isolate it from crashes. The BIOS is responsible for initializing the computer during start-up and performing other low-level functions.

Boolean operations Named after the nineteenth-century mathematician George Boole, Boolean operations are mathematical relationships based on a core logic that can be represented in a Venn diagram. In 3D modeling they are: Union (the combination of two sets), Intersection (the overlapping of two sets), and Subtraction (the part of one set remaining after an intersecting set is removed).

bump-mapping A visual trick that attempts to simulate a texture's roughness or smoothness, depending on how the texture reflects lights. In 3D, this is usually accomplished by laying two textures onto a polygon—a base texture for the graphics, and a second displacement texture that is mapped on the object. This second texture determines how "rough" the surface will appear.

bus bandwidth The clock frequency of a bus interface. To calculate peak bus throughput, multiply the bus frequency by the bus width. If a 100MHz bus is 64 bits wide, it transfers 8 bytes per clock cycle 100 million times per second—for a maximum theoretical throughput of 800MB/sec.

C

CAD/CAM Computer-Assisted Design/Computer-Assisted Manufacturing. Use of a computer to create schematics and blueprints. These systems must accurately dimension aspects and calculate dependencies.

Cascading Style Sheets A language applied to HTML to control the style of a document: which fonts and colors to use, how much white space to insert, etc. You specify the style at the top of the document, and it applies to all the elements on a page.

CISC Complex Instruction-Set Computing. An architectural design style for microprocessors that dates back to the 1970s. CISC processors try to conserve memory and other system resources by encoding program instructions in a compact format and by using complex instructions that perform multiple operations.

clock cycle One moment in the life of a microprocessor. During this "tick," electrical signals flow through circuits and turn transistors on or off, which is how a processor does its work. The number of clock ticks per second is the clock frequency, typically expressed in megahertz (200MHz equals 200 million cycles per second).

clock frequency The rate at which a microprocessor performs internal operations. This is regulated by a "clock" or oscillator that synchronizes operations inside the chip. It's expressed in clock cycles, e.g., 200MHz equals 200 million cycles per second.

CMYK separations Process of converting the RGB spectrum based on the light spectrum to a reflective physics system based on the four colors used in most printing: Cyan, Magenta, Yellow, and Black (which is represented as "K").

continuous tone As opposed to line art consisting of solid blocks of shades or colors, con-tone images (such as photographs or paintings) have a continual flow of hues.

core-logic system chipset Two or more chips on the motherboard of an IBM PC-compatible computer that connect the CPU to other system devices. The system chipset defines many of the features of a PC: how much main memory (RAM) it can hold, how many expansion slots it has, how much memory it can cache, and so forth.

D

DAC Digital/Analog Converter. The chip that converts a digital signal into an appropriate analog signal. Higher bits—i.e. 18, 20, 24—give you theoretical better resolution.

DAT Digital Audio Tape. A magnetic storage device. The first implementation of consumer and semi-professional stereo digital recordable audio. Still a popular format among musicians.

database integration When a web site uses a database back-end to store information, database integration refers to how a web interface can access that information.

diffuse tail As the echoes of reverberation build up on each other, the reverberation quickly reaches a crescendo, then dies away. The trailing end of the reverberation of a sound (particularly a sharp sound like a single hand-clap) becomes composed of so many echoes it sounds noise-like and "diffuse" as it decays to zero. Acousticians refer to this as the "diffuse tail" of the reverberation response.

digital audio Audio is pressure waves in air that our ears can hear. Rather surprisingly, these waves can be accurately expressed "digitally" as a list of numbers, each number representing the value of the air pressure at a single instant in time. Only about 100,000 numbers per second are required for stereo audio.

Direct RDRAM See RDRAM.

displacement map In the context of bump-mapping, a black-and-white map that describes how bumpiness will be simulated via shadowing.

distortion A change in an audio signal from input to output. Typically a change in level, or a fixed delay, is not considered a distortion, but any change that introduces new frequencies of sound is considered distortion.

DLL Dynamic Link Library. An indispensable little nugget of software that gets deposited surreptitiously on your hard drive and makes everything melt down when it's unintentionally uninstalled.

DSP Digital Signal Processor. A specialized processing unit generally used to perform just a few functions but at incredible speeds. DSPs are often found in cellular phones, fax machines, or soundcards. Digital Signal Processing is often used to denote conversion of an analog signal to digital. More commonly referred to in soundcards for processing of sound.

DVD Digital Versatile Disc. It's the next-generation CD-ROM, storing more data per disc, and also a possible replacement for videotapes, especially in the rental business. By using multiple layers and both sides of a disc, DVD can store 4.7GB to 17GB of data, while CDs are limited to a maximum 682MB.

Dynamic HTML HTML for the 4.0 browsers that allows pages to become more "dynamic" or "interactive." This includes ways to animate HTML. It is a collection of browser-specific behaviors based on combinations of the following standardized technologies: Document Object Model (DOM), HTML, Cascading Style Sheets (CSS), and EcmaScript (standardized JavaScript).

E

eighth-order interpolation When pitch shifting or changing the sample rate of digital audio, the signal is being "re-sampled." In other words, the value of the continuous audio waveform is needed at points in time other than those originally recorded. The mathematical process of finding an intermediate value of a curve between known data points is called "interpolation." The "order" of the interpolation is the number of known points on the curve that are taken into account in the calculation, and obviously the more data taken in, the more complex the math and the more accurate the result. The majority of wavetable synthesizers interpolate the curve by drawing a straight line between the two nearest neighbor points, this second order or "linear" interpolation is far inferior to the mathematically complex eighth order.

F

filters A filter is a circuit that ideally amplifies and attenuates different frequency components of a sound, thus changing its timbre and resonant quali-

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ties. Digital audio filters are difficult to design because the standard algorithms are particularly subject to distortion.

firewalls A software system that isolates a network (such as an internal corporate intranet) from the rest of the Internet, permitting only specific data to pass in and out.

flanging The result of adding together a sound with a version of the same sound that has been delayed by a small, but variable, time. The result is a complex change in timbre caused by the adding together of certain frequencies of sound, and the cancellation at other frequencies. So called because it was first done by varying the delay of the sound by putting fingers on the flange of the reel on a tape recorder.

floating point A fractional number, such as 9.95 or 98.6. Computers have a more difficult time working with floating-point numbers than they do with integers (whole numbers), but the higher precision of floating point is required for some operations.

FMV Full-motion video. Video that plays at full screen on your PC. It can be used for interactive games such as *Tex Murphy Overseer*, or for cut scenes to further a story along such as *Heart of Darkness*.

focal length The degree to which a viewing lens displays the distortion and perspective associated with wide-angle and telephoto lenses.

FP see floating point

FPU Floating-point unit. A function unit (collection of circuits) in a microprocessor that executes floating-point instructions.

frame buffer a block of memory for temporarily storing information displayed on the screen. Graphics cards usually have a few megabytes of fast memory for this purpose. The larger the frame buffer, the more resolution and colors a computer can display. 3D graphics cards may also store 3D objects and textures in a frame buffer.

frontside bus The main system I/O (input/output) interface that connects a microprocessor to other system devices. Typically, it allows the processor to communicate with main memory (RAM), the system chipset, PCI devices, the AGP card, and other peripheral buses. It also connects to the Level 2 cache unless the processor has a backside bus.

fuzz pedals A simple nonlinear electronic device popular with musicians that causes interesting and pleasing distortion to the sound, most typically used with electric guitars.

FX engine A DSP specifically designed to implement audio-effects processing. Such a DSP would be particularly well-designed for implementing low distortion filters and long delay lines.

G

geeky Used to describe the fickle tastes of individuals who spend much of their social lives in front of a computer and sprinkle their conversations with mre acronyms than adjectives.

GFLOP A billion floating-point operations per second. FPUs may be compared in terms of how many GFLOPs they can perform.

GIF89a LZW-compressed image format limited to 256 colors. The 89a spec adds transparency to the animation abilities included in the 87a spec.

H

HRTF Head-Related Transfer Functions. Filters applied to sound to simulate 3D positional sound. Created through analysis of how humans perceive sound with two ears.

HTML HyperText Markup Language. A system for describing parts of a web document that tells web browsers how to display the document's text, links, graphics, and other media.

I

image map A web image with multiple associated links instead of just one. Image maps can be built as both "client side" (the browser supports the code to define where users can click) or "server side" (the web server supports the code to define where users can click). All 3.0 browsers and up support client-side image maps, which is recommended.

initial reflections When a sound is made in an enclosed space, it bounces off all the surfaces repeatedly. Our ears and brains make use of the first few bounces we hear, called the "initial reflections," to judge how far we are from nearby walls. However, once sound that has come via multiple bounces begins to reach our ears, we perceive the effect as reverberation and can no longer use the information to locate any particular feature of the space.

integration Adding more functions to a chip. Over time, advances in manufacturing technology make it possible to squeeze more transistors onto a silicon chip. Engineers can use those transistors to add more functionality. Devices that used to be built as separate chips can be combined into a single chip.

interlaced When even lines are displayed after odd lines on a CRT (Cathode Ray Tube) terminal or TV. This method of displaying an image creates an irritating flutter that is visible when still images such as text are displayed. Most computer displays are noninterlaced.

invisible images Transparent images on web pages with pixel-level precision. You can make a clear/invisible image in any image-editing tool that exports transparent GIFs.

J

Java Sun Microsystems' high-level programming language. It is a general-purpose, object-oriented language that works well on the World Wide Web.

L

lathed A technique for generating 3D models based of the principle of the lathe machine you might have seen in shop class. A polygon is rotated on an axis and the resulting trails create the object's volume.

layers Convention in graphics apps that simulates transparent sheets laid over the artwork. Complex images can have work saved on many of these layers for easier editing and access to buried regions.

legacy support Refers to backward compatibility with older hardware or software. In soundcards, DOS legacy support refers to support for the Sound Blaster standard, including the correct audible response when the software writes directly to the audio hardware without going through the operating system drivers.

Level 2 cache The second-fastest memory available to a microprocessor (second only to the Level 1 cache). It usually consists of SRAM chips near the processor, although some recent processors have on-chip L2 caches. Also known as secondary cache.

level of detail LOD. A description given to a graphic that has multiple-sized versions of itself, ranging from a small size such as 10x10 pixels, up to a high resolution such as 256x256 pixels. In a game, different levels of detailed textures are used to conserve processing power—the lower the level of detail, the lower the resolution, and the lower the size.

linear Literally relating to a straight line. Because of certain mathematical theorems, electronic devices that use "linear" processes cannot generate any new frequencies in the sound. This linear processing is desirable from the standpoint of distortion, but undesirable from the standpoint of creating complex timbres.

M

memory controller A chip (or part of a chip) that manages the interface between a microprocessor and its associated memory chips. The efficiency of the controller partly determines how fast the processor can access memory.

microprocessor core The central part of a microprocessor chip that carries out program instructions. It's also referred to as the "logic." To assist the core, a microprocessor usually incorporates fast local memory, known as cache. Sometimes cores are designed to be used in highly customized chips for specialized applications.

MIPS Acronym for million instructions per second. MIPS roughly measures the number of instructions a computer can execute in a single second. The higher the MIPS, the faster the PC is.

MMX Unofficially it stands for Multimedia Extensions, though Intel insists it's just a brand name. Introduced in early 1997, MMX consists of 57 new instructions that speed up some multimedia tasks in x86-compatible microprocessors. It's also supported by chipmakers AMD, Cyrix (National Semiconductor), and Centaur Technology (IDT).

modeling A way of devising algorithms for processing sound based on imitating the equations that govern natural sound.

Morpheus technology A method of continuously changing, or "morphing," sounds from one audible effect to another, using extremely high order resonant digital filtering, first used in the E-mu product called "Morpheus."

MPEG-2 An audio/video standard formulated by the Moving Pictures Expert Group and widely supported throughout the industry. It defines methods for compressing and decompressing audio and video data to conserve resources in computers, digital TVs, and other multimedia devices.

N

nested A technique for embedding a toolbar or floating palette with additional elements that are not immediately visible. Instead these secondary tools require another drag or a click to access.

noisy Not quiet. PCs are a hotbed of noise. For soundcards, reducing the overall noise is important to improve the overall sound quality of the output. Noise is a random signal, typically perceived as "hiss." Many electronic processes generate noise and are said to be "noisy."

nonlinear Not obeying linear mathematics. Nonlinear electronic processes can do more complex things, as they can introduce new frequencies into the sounds being processed. But they are more complex to design and analyze and can often cause undesirable distortion.

nonstandardized code Programming languages, such as HTML, have industry-accepted standards that a group of experts in the field have agreed on. Sometimes software used to create this code does not follow the industry standard because the application works faster if it uses proprietary code.

O

obstruction effects An effect that simulates sound after it's passed through an object, such as a wall. It does not require geometry attributes.

occlusion A blockage or occlusion in audio is the difference between hearing a sound without barriers and then behind, say, a door or wall.

optimized In web graphics, this is a color palette that has had all unused colors removed, making for a smaller, faster loading image.

oscilloscope An instrument used to view electronic waveforms.

out-of-order execution The ability of a microprocessor to rearrange the order of program instructions while the program is running. It's a technique for using the processor's internal resources more efficiently. However, the processor always saves the results of the instructions in their original program order.

P

P6 Intel's code name for a sixth-generation x86 microprocessor chip. The Pentium Pro was the first P6-series processor, followed by the Pentium II, Celeron, and Xeon.

parameter A number that describes an aspect of something. For example, some parameters we might use to describe a sound would be loudness, frequency, and duration.

perceptual parameters Parameters are based not on physical measurements (such as the size of a room) or engineering convenience (such as the coefficient in an equation), but instead on the way we would perceive and describe what we hear. For example, we might say that a particular room was highly reverberant or not very reverberant, so degree of reverberation would be a perceptual parameter.

physics engine The underlying programming and mathematical code within a gaming engine that determines how objects will react within the gaming world. It's used to simulate gravity, friction, and other real-world attributes.

pipeline an assembly line for program instructions. A pipelined function unit in a microprocessor separates the execution of a program instruction into multiple stages. Instructions flow through the pipeline like cars on a factory assembly line: multiple instructions are in various states of completion.

pitch-shifting The process by which a recording of a single note is transformed into other notes of the scale during wavetable synthesis.

pixel The smallest unit of resolution on a video screen. Everything on the screen is formed of pixels. More pixels are better, because the screen can display more detailed images. Screen resolution is often expressed in pixels—1024x768 means a screen displays 1024 pixels horizontally by 768 pixels vertically, for a total of 786,432 pixels.

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PNG Portable Network Graphic. Bitmap image format created to replace GIFs when patent claims threatened to shut down the web.

point sampling Refers to textures that are displayed on-screen without any smoothening filters applied. This will result in lost detail and pixels being blocky.

R

raster-based A fixed-resolution image comprised of a static Cartesian grid of pixels. These images cannot be scaled without interpolation that diminishes visual quality.

rasterize The final phase in the videocard pipeline where image data is displayed on-screen as a single, continuous bitmap graphic.

RCA-out A composite analog video-out port to connect devices such as notebooks or DVD players to a television set.

RDRAM Rambus Dynamic Random Access Memory. It's a proprietary but widely licensed memory standard controlled by Rambus that transfers data much faster than current standards such as EDO RAM and SDRAM. The latest incarnation, Direct RDRAM, supports transfer rates as high as 800MHz, compared to 66MHz for EDO RAM and 100MHz for SDRAM.

realtime To execute on-the-fly or in immediate or concurrent time. In other words, a computer action that is not predetermined or pre-recorded. Processing that occurs without apparent delay or interruption.

register A small storage cell in a microprocessor that temporarily holds numbers used by a running program. Usually the registers are 16, 32, or 64 bits wide. Program instructions put values in the registers, perform operations on the values, and copy the results back to memory.

reverberation The result of sound reflecting off many surfaces, as in a concert hall or any enclosed space. The result is a vast number of echoes, which often adds a pleasing resonant quality to music.

RISC Reduced Instruction-Set Computing. RISC is an architectural design style for microprocessors that was invented to supersede CISC. It tries to maximize performance by encoding program instructions in a fixed-length format and by using simpler instructions that execute in fewer clock cycles.

roll-overs Effect in digital media where one image is replaced with another when a hot spot is entered by the mouse cursor. An example is a button that lights up when you move the mouse onto it.

S

samples A sample is the recording of a single note or sound effect used within a sound library.

SDRAM Synchronous Dynamic Random Access Memory. A faster type of memory that synchronizes with the CPU. Its architecture allows it to run fast enough to handle the 100MHz system bus.

Slot 1 an interface that attaches Intel microprocessors to motherboards. Introduced with the Pentium II, it's a slot that accepts a daughtercard, which in turn contains the processor and Level 2 (L2) cache. It's electrically compatible with Socket 8. Intel does not license Slot 1 to other processor makers. It currently runs at 66MHz or 100MHz.

Slot 2 an interface that attaches Intel microprocessors to motherboards. Introduced with the Xeon, it's a slot that accepts a daughtercard, which in turn contains the processor and the Level 2 (L2) cache. It's intended for servers because it's larger than Slot 1 and can hold more cache chips. Like Slot 1, it's electrically compatible with Socket 8. Intel does not license Slot 2 to other processor makers. It currently runs at 100MHz.

Slot A an interface that attaches AMD K7 microprocessors to motherboards. Almost identical physically to Intel's Slot 1, it accepts a daughtercard that in turn contains the processor and Level 2 (L2) cache. It's not electrically compatible with Slot 1, however. AMD licensed the basic design from Digital Equipment Corp. The initial version will run at 200MHz.

SMP Symmetric Multiprocessing. SMP systems have two or more microprocessors and an operating system that tries to distribute workloads evenly among the processors.

Socket 7 An interface that attaches x86-compatible microprocessors to system motherboards. Originally designed by Intel for the Pentium, Socket 7 also works with processors made by AMD, Cyrix, Centaur, and others. It is being superseded by Super 7 and Intel's P6 slots because it runs at only 66MHz.

sound library The collection of instrumental note or sound-effects recordings, along with the instructions on how to alter the pitch, filtering, and envelopes of the sounds for each note on the keyboard, which is used in wavetable synthesis.

source code The source code is the language that sits under what the user sees. For example, you can "view source" in a web browser to see the HTML that makes a page look like a page.

specmanship A pissing match between two or more competitors who spew stats and numbers faster than that green-blooded, pointy-eared Vulcan.

SRAM Static Random Access Memory. A very fast type of memory chip that's often used for Level 2 (L2) cache and video memory because of its speed. However, it's too expensive to use for main memory, which usually consists of slower DRAM (Dynamic Random Access Memory). SRAM is faster than DRAM because it doesn't have to be constantly refreshed to retain its data.

Super 7 A refinement of the Socket 7 microprocessor interface, which attaches x86-compatible processors to system motherboards. Super 7 can run at 100MHz, or 50 percent faster than Socket 7's 66MHz. That makes it easier for system devices to keep up with the processor.

SuperDisk A successor to the floppy disk drive, the SuperDisk offers 120MB of storage capacity, faster speeds, and backward compatibility with legacy 1.44MB and 720K media. The SuperDisk can also be used as a bootable device.

superpipeline a very long instruction pipeline in a microprocessor. The Pentium Pro, Pentium II, Celeron, and Xeon processors are superpipelined. It's a way of achieving higher clock speeds, but one drawback is greater penalties for mispredicting conditional branches.

superscalar Parallelism. A superscalar microprocessor can execute more than one program instruction at a time. Multiple function units make it possible.

S-Video Super-Video: A video standard that divides the signal to carry brightness and color information separately. Also referred to as Y/C, it is a connector that carries the video signal in its separate luminance and chrominance components. If you have this and composite jacks on your camera or deck, use the S-Video for better picture quality. S-Video uses a five-pin connector, not RCA jacks.

synthesizers Synthesizers are electronic musical instruments that create a wide variety of expressive instrumental timbres, including the ability to imitate most acoustic instruments as well as completely novel sounds.

system chipset See core-logic system chipset.

system I/O bus The main input/output bus on a microprocessor. It's the interface that connects the CPU to most other system devices, such as main memory (RAM), PCI devices, the AGP card, the system chipset, and often the Level 2 (L2) cache. Also known as a frontside bus.

T

tables Tables are a feature of HTML that allows designers and developers to lay out rows and columns of information.

tag RAM Memory chips that store memory addresses for use by a microprocessor's Level 2 (L2) or Level 3 (L3) cache. The memory addresses point to locations in main memory (RAM) from which the data in the cache came. Without enough tag RAM, the cache can "see" only a limited amount of the system's total memory.

textures The surface graphics on a 3D object. Without textures, 3D objects look like naked skeletons of polygons. Textures add realism—a brick wall, the skin of a lizard, or the gleaming metal surface of a spaceship. A 3D program stores a texture as a graphics pattern and applies it to the structure of polygons.

TFT Thin Film Transistor: The essential component in any modern LCD notebook or flat-panel display.

3DNow! 21 new instructions that speed up 3D graphics and other tasks on x86-compatible processors. Introduced in 1998 with AMD's K6-2 processor, 3DNow! also has the support of chipmakers Cyrix (National Semiconductor) and Centaur Technology (IDT). Notably missing from this loose alliance is Intel, which is introducing its own Katmai instructions in early 1999.

trapping Process of bleeding ink into the surrounding region to prevent bare paper from being exposed with misregistration during printing.

trilinear filtering A method to make textures appear less pixelated. It involves applying a bilinear filter to two mip-maps on either side of a texture. The resulting filtered texture is then filtered again, hence the "tri" in trilinear. Trilinear filtering is processing intensive, but results in a smoother overall look.

U

übergame The catchphrase for the industry standard: "Highly anticipated."

unconverted Typography made up of Postscript fonts that have not been converted into a raw, vector-based format.

V

vector-based Static graphics, animations, and fonts created as mathematical descriptions, consisting of a collection of lines, curves, and shapes.

W

wavelengths A pure sound has a single frequency or pitch, and consists of a sinusoidal variation of air pressure that in many ways is similar to the periodic waves of the ocean. As the wave travels through air at the speed of sound, the distance between crests of highest pressure is called the wavelength of the sound, which depends on its frequency. The most bass sounds we can here, at 20Hz, have wavelengths of about 50 feet, and the highest pitched sounds at 20kHz have wavelengths of half an inch.

wavetable audio A technique for generating sounds from digital samples. Wavetable synthesis stores digital samples of sound from various instruments, which can then be combined, edited, and enhanced to reproduce common timbres as well as unique hybrids. Often, a 2MB or 4MB wavetable bank of the General MIDI (GM) spec will be stored in ROM on the soundcard so that all MIDI files will sound generally the same, with the only variable the quality of the ROM patches.

wavetable synthesis A highly successful method of producing music electronically in which recordings of single instrumental notes are transformed by means of pitch-shifting, filtering, and enveloping into a complex musical performance under the control of a MIDI score. A technique for generating sounds from digital samples. Wavetable synthesis stores digital samples of sound from various instruments, which can then be combined, edited, and enhanced to reproduce common timbres as well as unique hybrids. Often a 2MB or 4MB wavetable bank of the General MIDI (GM) spec will be stored in ROM on the soundcard so that all MIDI files will sound generally the same, with the only variable the quality of the ROM patches.

wavetracing A technique for rendering realistic 3D soundscapes by tracing the paths of sound and reflections in relation to a player's position in a game.

WYSIWYG editor What You See Is What You Get. An industry buzzword for a graphical editing tool that lets you build web and software applications by dragging and dropping elements without understanding the language the editor is using.

X

X Jack A pop-up connection on PC card modems that allows you to connect a standard telephone cable.

x86 A microprocessor architecture invented by Intel and widely used by other companies. The 486, Pentium, Pentium Pro, Pentium II, Celeron, Xeon, AMD K6, Cyrix M II, and Centaur WinChip are all x86-compatible processors. The first x86 chip was the 8086 in 1978.

.xl The file extension for a Microsft Excel document, just as the extension on a word document is .doc or the extension on a web document is sometimes .html

XML A newer language for the web based on SGML, which significantly improves the capability of online programming.

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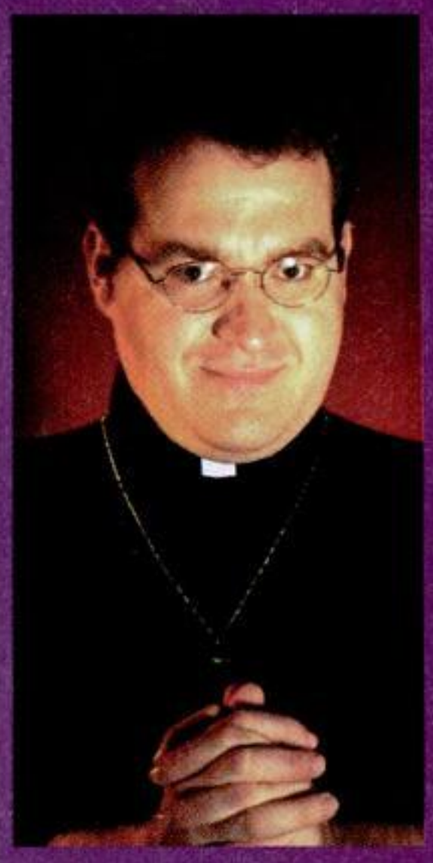

ALEX ST. JOHN was the architect of DirectX while an evangelist at Microsoft. Since leaving the empire, he has remained a player, brokering many deals in the industry. Reach him at **saint@maximumpc.com.**

During my five years with Microsoft's Developer Relations Group (DRG), I worked at the forefront of the Empire's competitive efforts, and believe me, those efforts were fearsome.

I'm not a lawyer, so I have no idea if the things we did would be classified as "anti-competitive," but we were certainly very focused on the task of expanding Microsoft's dominance in every critical aspect of the software industry. Now the government is pursuing a landmark case against Microsoft for "criminally" succeeding in its competitive efforts.

First off, let's cut the crap. *Of course* Microsoft is a monopoly. Duh. And it's so successful that even our biggest institutionalized monopoly—the federal government—feels threatened. Maybe if the government hassles a little 20,000-employee monopoly like Microsoft, nobody will notice the million-employee postal monopoly that prevents UPS and FedEx from competing on even ground with it. Is Microsoft a monopoly we want the government saving us from?

And is Microsoft really so powerful that unseating it with better technology and business sense is impossible? Or is it just that the people who really have what it takes to lead the industry haven't emerged yet? Are the companies that go crying to the government for redress when they lose *really* the new leaders we want in Bill's place? It seems to me that turning to the government for help is a way of saying, "We surrender, we just aren't smart enough, fast enough, or innovative enough to beat them." I don't think Microsoft has sucked all the opportunity out of the industry... yet. I don't think *all* the smart people are used up. Intuit, Adobe, and Electronic Arts all built great software empires on Microsoft's back despite the Empire's best efforts to stop them. These companies are proof that opportunity is there for those strong enough to take it. I'd hate to see an institution like Microsoft get chewed up by the likes of the government before the next generation of great minds gets a chance to take a swing at Bill. I want my shot in the ring with a champion, and I hope for the sake of this industry that everybody who dreams of building great things wants it that way too.

Microsoft Under Fire

THE KING IS DEAD; LONG LIVE THE KING

And back to that monopoly point. Yeah, Microsoft is a monopoly—an *international* monopoly! How many other industries can you think of in which America is a world leader? Microsoft—and Intel, which is fending off its own monopoly charges—pulls billions of dollars into the U.S. economy. The United States is the world supplier of software and CPU technology. It fuels hundreds of thousands of jobs in our country. It's easy to root for underdogs such as Sun, Apple, Oracle, and Netscape, but does anybody consider the consequences of destroying our monopoly? This would open the door for software and hardware development in other nations, and I sure hope those governments are as conscientious about anti-competitive practices as our government has been. The Japanese certainly weren't very sympathetic when we started making crappy cars. The only successor to Microsoft I'd like to see is somebody stronger.

Finally, let's discuss the notion of "breaking up" Microsoft. When the government felt compelled to spend millions of our dollars hassling IBM, Big Blue was making all the hardware *and* all the software, plus it was doing all the manufacturing and distribution. Microsoft just makes software. Dell, Gateway, and Compaq are the manufacturing and distribution divisions; Intel and AMD are the CPU divisions; and Seagate, Quantum3D, 3Dfx, ATI, nVidia, LSI, and dozens of others make the other components, peripherals, motherboards, memory, and so forth. None of these companies would exist, or have a significant market for their product, if Microsoft hadn't created one. It would all still belong to IBM.

Microsoft is already a divided monopoly. Conflicts between Microsoft and any of these companies should be regarded simply as internal politics. They are all highly interdependent, and the squabbles we see in the media are really just a giant ongoing budget negotiation process. That's the real reason none of them are testifying against Microsoft. Wounding Microsoft would just hurt them all.

I'd hate to see an institution like Microsoft get chewed up by the likes of the government before the next generation of great minds gets a chance to take a swing at Bill.

Microsoft isn't half as fast as it used to be. It has thousands of docile millionaires clogging its arteries. They have become self-absorbed and detached from the needs of their customers and the greater movements of the industry. The free market worked fine the last time the computer industry faced this threat from an even bigger, more entrenched monopoly. Let it work again. The next generation of technology makers should get the honor of taking the old king's crown in battle, not have it handed over by an executioner.

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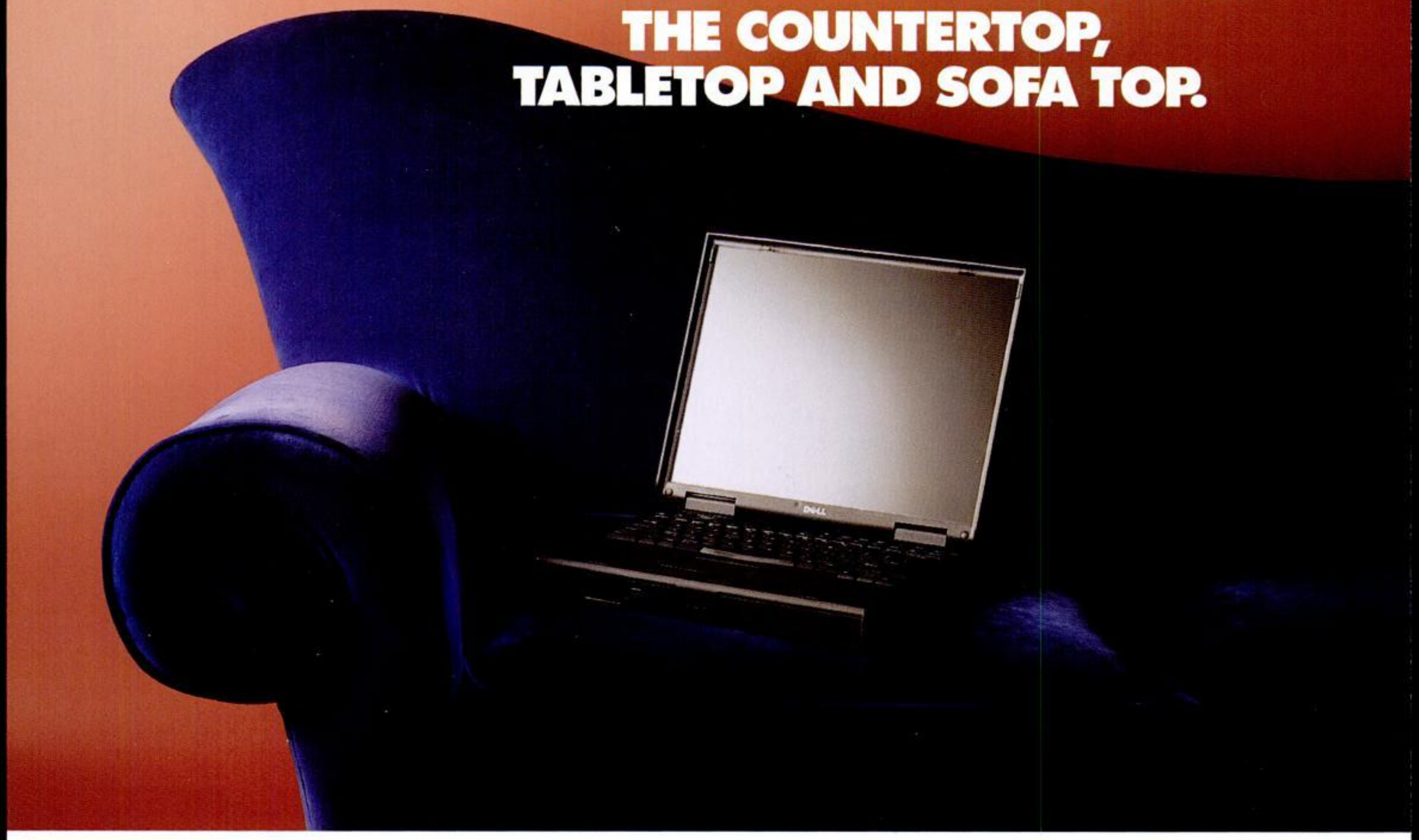

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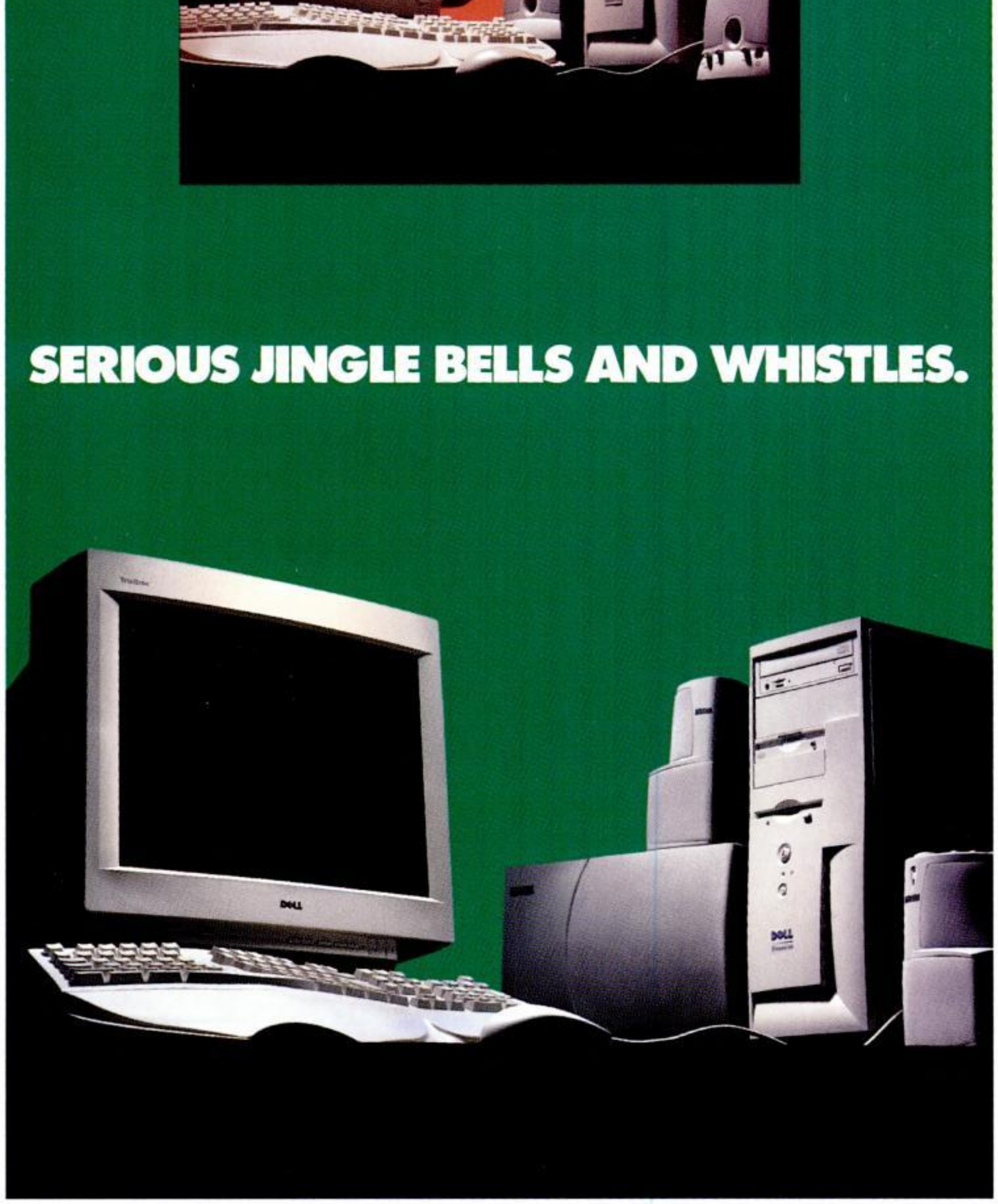

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- 8.4GB Ultra ATA Hard Drive
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- 40X Max≈ Variable CD-ROM Drive
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- Dell QuietKey® Keyboard
- Logitech First Mouse+ Wheel (PS/2v)

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- ATI 8MB 3D AGP Graphics
- 4.8X DVD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
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- 64MB SDRAM
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- Removable Combo 24X Max^^ Variable CD-ROM and 3.5" Floppy Drive
- 2X AGP 4MB ATI Rage Pro 3D Video
- Internal 56K Capable^π Data/Fax Modem
- 30-Day Trial Offer ConnectDirect Internet Service
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- 4.8X DVD-ROM Drive
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- 30-Day Trial Offer ConnectDirect Internet Service
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- 2X AGP 8MB ATI Rage Pro 3D Video
- Internal 56K Capableπ Data/Fax Modem
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